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OSAGE (MARAIS DES CYGNES) - GASCONADE DRAINAGE BASINS

Public Health Service
Cincinnati, Ohio

March 1952

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For Clean Water—"One River, One Plan"

OSAGE (MARAIS DES CYGNES) GASCONADE DRAINAGE BASINS

A COOPERATIVE STATE - FEDERAL REPORT ON WATER POLLUTION

MARCH 1952

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FEDERAL SECURITY AGENCY
Public Health Service

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FOREWORD

OSAGE (MARAIS DES CYGNES) - GASCONADE POLLUTION REPORT

The beautiful Ozarks area, with its magnificent lakes and streams, its many miles of scenic highways and well equipped resorts, its rolling farmland so well suited for dairying, and its wealth of mineral deposits, are included in the most treasured resources of Kansas and Missouri. The Osage, to which the Marais des Cygnes is tributary, and Gasconade Rivers form a large part of this valuable area. Thousands of tourists from every state in the Union enjoy vacations amid the unique beauty of the Ozarks each year.

It is unthinkable that the residents of the two states should let pollution mar or destroy this valuable asset which nature has so kindly bestowed upon them. The beautiful surface waters - so valuable to any area - are used to supply the needs of both community and industry. The streams and lakes in the vacation areas are used extensively for fishing, swimming, and other forms of recreation. Without clean, pure water much of the value of this beautiful area would be lost. For these reasons, we must continue the battle to keep the area free from unwarranted pollution - we must, in fact, step up our battle to control the pollution which now exists.

Within the pages of this report will be found the complete story of pollution in the Osage (Marais des Cygnes) and Gasconade River basins. A plan will also be found there - a plan to free the basin of unwanted pollution, and keep it free for the benefit of those who will follow us.

We respectfully urge all citizens of Kansas and Missouri - whether they live in these basins or not - to join in the fight to save their cities, farms, and vacation areas, from pollution; and to support the stream pollution program of their state as a part of a balanced program of health protection for the area and for the States of Kansas and Missouri.

Thomas R. Hood, M. D.
Executive Secretary
Kansas State Board of Health

Buford Hamilton, M. D.
Director
Division of Health of Missouri

Kansas State Board of Health, Bureau of Sanitation.

A REPORT OF WATER POLLUTION

IN THE

OSAGE (MARAIS DES CYGNES) - GASCONADE DRAINAGE BASINS

Prepared by

KANSAS STATE BOARD OF HEALTH
Division of Sanitation

MISSOURI DIVISION OF HEALTH
Bureau of Public Health Engineering

PUBLIC HEALTH SERVICE
Division of Water Pollution Control
Missouri Drainage Basin

Federal Security Agency
Public Health Service
MARCH 1952

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INTRODUCTION

The Federal Water Pollution Control Act, Public Law 845, passed by the 80th Congress in June 1948, requires the Surgeon General of the Public Health Service to cooperate with other Federal agencies, with State and interstate water pollution control agencies and with municipalities and industries in the preparation or adoption of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof, and improving the sanitary condition of surface and underground waters. Due regard must also be given to improvements necessary to conserve the waters for public water supplies, propagation of fish and aquatic life, recreational purposes, agricultural and other legitimate uses.

This report is produced under the coauthorship of the Missouri Division of Health, Kansas State Board of Health, and the Public Health Service. It is based on data available as of March 1, 1952, on sources of pollution, treatment facilities employed, and stream conditions. The report also presents information concerning use of water resources, pollution entering water resources and resulting damages, benefits which may result from pollution prevention and abatement, pollution prevention measures in effect and those which appear to be needed.

Data and knowledge now available are sufficient to permit the immediate solution of most of the pollution problems within the Osage (Marais des Cygnes)-Gasconade River Basins without awaiting the results of additional surveys and studies.

A sincere effort has been made to present a fair picture of the water pollution problems in the Basins and to present reasonable conclusions and recommendations. It is our hope that this report, as a step in the cooperative development of an ultimate comprehensive water pollution control program, will help in safeguarding the water resources.

ACKNOWLEDGMENTS

The cooperation of the State water pollution control agencies of Kansas and Missouri in furnishing data for this report is acknowledged with appreciation.

Acknowledgment is also made to the Corps of Engineers, U. S. Army, Department of Defense; Bureau of Reclamation, Fish and Wildlife Service, and Geological Survey, Department of Interior; the Weather Bureau, and Bureau of Census, Department of Commerce, whose published reports furnished much of the information contained herein on the history, hydrology, stream discharges, population trends, and economic development of the Osage (Marais des Cygnes)-Gasconade Basins.

Thanks is also tendered to the reviewing agencies, whose comments have materially aided the preparation of the report. These include the Corps of Engineers, Missouri River Division, Omaha, Nebraska; Bureau of Reclamation, Region 7, Denver, Colorado; National Park Service, Omaha, Nebraska; Fish and Wildlife Service, Billings, Montana; Federal Power Commission, Chicago, Illinois; Department of Agriculture, Lincoln, Nebraska; Department of Commerce, Denver, Colorado; and the Division of Water Pollution Control, Public Health Service, Washington, D. C. Data supplied by the Missouri Conservation Commission is sincerely appreciated.

SUMMARY

The area drained by the Osage (Marais des Cygnes) and Gasconade Rivers contains approximately 18,900 square miles and is about equivalent in size to the combined areas of the States of New Hampshire and Vermont. The Marais des Cygnes River rises in eastern central Kansas and flows generally eastward to its junction with the Little Osage River and is therefore known as the Osage River. The Osage joins the Missouri River in central Missouri. The Gasconade is an intrastate stream rising in south central Missouri and flowing generally northward to join the Missouri River a few miles downstream from the mouth of the Osage. The topography of the watersheds ranges from gently sloping hills of eastern Kansas to rough, broken, submountainous terrain typical of the Ozark uplift of central Missouri.

The economy of the region is supported largely by agriculture with most of the gainfully employed depending upon agriculture and related industries for their livelihood. The rural aspect of the area is further emphasized by the fact that only one-fourth of the people dwell in cities, towns, or villages. The largest city is Ottawa, Kansas, population 10,051 in 1950. The Basins also support a growing tourist trade. Mineral resources consist of oil, natural gas, and coal.

Surface water resources serve many important uses, including domestic water supply, livestock watering, fish and wildlife propagation, recreational activities of many types, hydroelectric power, and removal and ultimate disposal of domestic and industrial wastes. A measure of the use and value of water resources is indicated in the following examples: (1) approximately 45,000 people in 19 localities depend on surface water for municipal supplies; (2) approximately 2,000,000 people each year use the streams and lakes of the area for recreation.

The substantial degree of pollution control now exercised in the Osage (Marais des Cygnes) - Gasconade Basins is largely the result of abatement programs conducted by the State water pollution control agencies of Kansas and Missouri, and the interest of a concerned local citizenry. In the absence of large municipalities or large industries, organic pollution has been confined to stream reaches immediately below sewer outfalls. However, acid and highly mineralized drainage from abandoned strip mining operations in western Missouri and eastern Kansas has adversely affected fishing in more than 170 miles of stream. The complete control of mine drainage is a problem of considerable magnitude and complexity.

Wastes from 53 sources (44 municipalities and 9 separately sewered industries) are discharged to streams of the Osage (Marais des Cygnes) and Gasconade River systems. Three of the nine industries having separate outlets provide some measure of waste treatment. Forty-two of the 44 sewered municipalities have provided treatment facilities. An estimate of the population equivalent of organic wastes produced from all sources prior to treatment is approximately 98,000. After treatment, pollution equivalent to that from 42,000 people is discharged into the river systems. This represents a reduction of about 57 percent.

A resumé of waste treatment needs indicates that eight new[1] municipal plants, eight new industrial waste treatment plants, addition to or enlargement of nine municipal plants and one industrial plant, and replacement of two municipal plants are necessary (table 1). Treatment afforded by the facilities recommended for construction in this report will reduce the pollution entering the waterways to about 20,000 population equivalents, an amount which can be assimilated in the streams of the Basins without detrimental effects. This represents an over-all removal of approximately 80 percent of the polluting materials.

Interstate pollution from municipal sewage has been experienced during past years in the Marmaton River below Fort Scott, Kansas. A new sewage plant, employing a high degree of treatment, is now in operation at Fort Scott to alleviate such pollution. All but one of the sewered municipalities in the Kansas section of the Osage Basin now have secondary sewage treatment.

The difficulty of financing municipal sewage works has in the past been the principal deterrent to completion of the abatement program in Missouri. However, legislative action in 1951 permits municipalities to issue sewer or combined water-sewer revenue bonds to finance installation and operation of municipal treatment works. The greater flexibility now allowed in financing municipal plants should speed construction of recommended works in the State of Missouri. The financial legislation of the State of Kansas has been somewhat more liberal than that of Missouri and has not hindered municipalities in the Kansas section of the Osage (Marais des Cygnes) Basin from constructing treatment works.

The principal benefits to be derived from completion of the pollution abatement program in the Osage-Gasconade Basins will be in the nature of increased protection for livestock watering, recreation, fish propagation, and public water supplies.

The cost of providing recommended new installations and improvements to existing plants is conservatively estimated at $1,000,000. This figure does not include the cost of constructing new sewer systems and sewage treatment works in municipalities where none have existed prior to this time. Data concerning the sources of pollution are generally quite complete.

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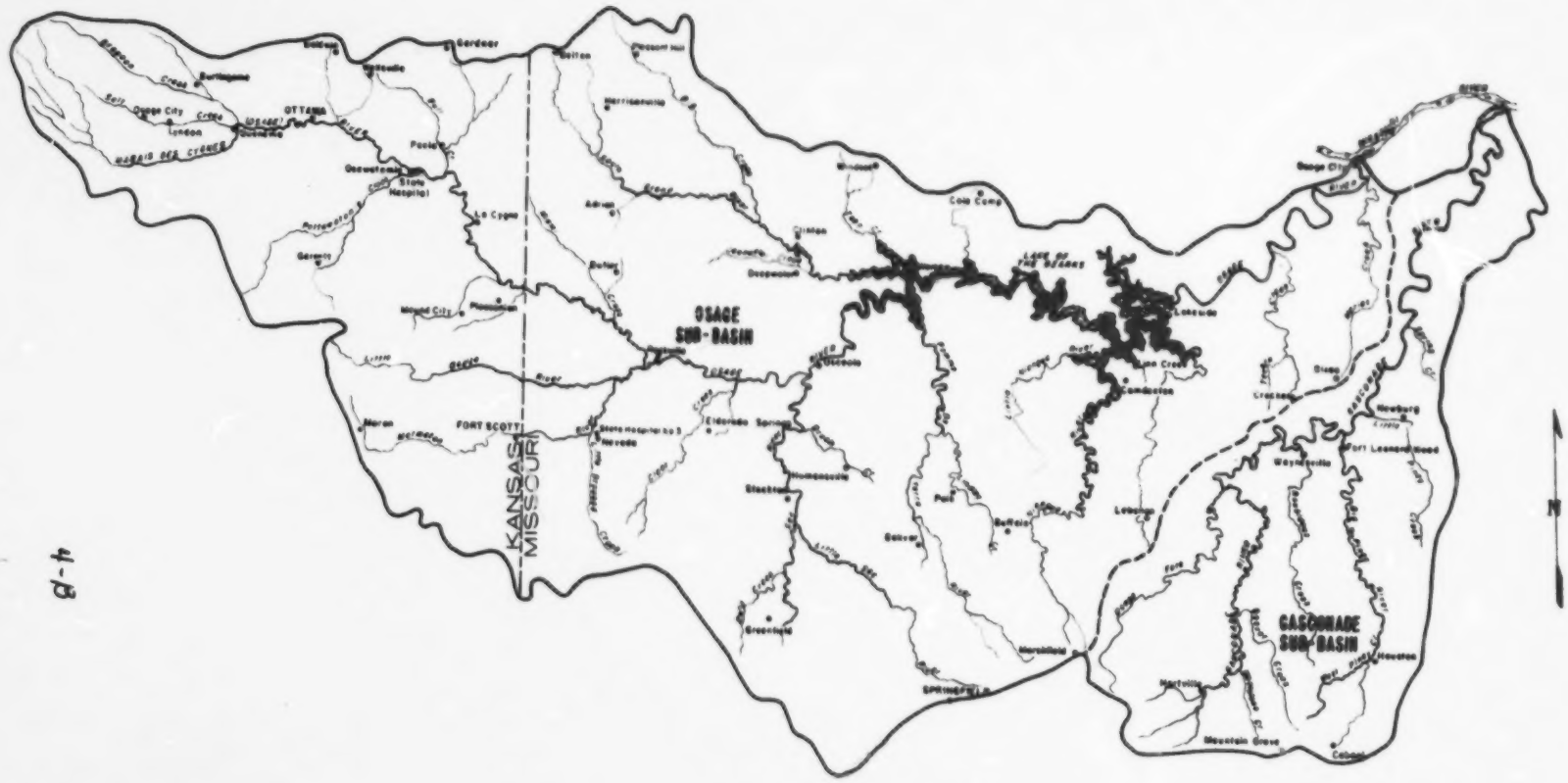
[1]States consider 6 plants to be entirely new even though the municipalities have had treatment works previously.

Table 1. Osage (Marais des Cygnes) - Garconade River Basins - Municipalities and industries needing improvements for abatement of pollution

Name	Estimated population served	Project required**
Kansas		
Fort Scott	10,000	Additions (Secondary)
LaCygne	700	Additions (Secondary)
Lyndon	600	Replacement (Secondary)
Pleasanton	1,000	Replacement (Secondary)
Missouri		
Belton	800	Enlargement (Secondary)
Bolivar	1,977	Enlargement (Secondary)
Buffalo		
Cheese Plant	720*	New plant (Secondary)
Camdenton	80	New plant (Secondary)
Clinton	3,740	Enlargement (Secondary)
Meat Packing Plant	480*	New plant or other means of control (Secondary)
Eldorado Springs	860	Additions (Secondary)
Greenfield	780	Enlargements (Secondary)
Hartville		
Cheese Plant	450*	Enlargement (Secondary)
Harrisonville	1,600	New plant (Secondary)
Humansville		
Cheese Plant	800*	New plant or other control measures (Secondary)
Lebanon		
Meat Packing Plant	550*	New plant or other control measures (Secondary)
Newburg	150	Additions (Secondary)
Nevada	5,200)	
State Hospital No. 3	2,400)	New plants (Secondary)
Osceola	500	New plant (Secondary)
Cheese Plant	1,400*	New plant or other control measures (Secondary)
Pleasant Hill	1,510	New plant (Secondary)
Polk		
Cannery	340*	New plant or other control measures (Secondary)
Rockville		
Cheese Plant	160*	New plant or other control measures (Secondary)
Stockton	100	New plant (Secondary)
Cheese Plant	1,040*	New plant or other control measures (Secondary)
Warsaw	660	New plant (Secondary)

*Industrial waste organic population equivalent.

**Degrees of treatment are as recommended by State water pollution control agency.


OSAGE
SUB-BASIN
GASCONADE
SUB-BASIN
KANSAS
MISSOURI
FORT SCOTT
OTTAWA
Lake of the Ozarks
Osage City
Burlington
London
Gordeer
Dalton
Harrisonville
Warsaw
Cole Camp
Lebanon
Waynesville
Fort Leonard Wood
Houston
Mountain Grove
Springfield
Eldorado Springs
Stockton
Greenfield
Nevada
Clinton
Butler
Osceola
Lowry City
Hermitage
Humansville
Buffalo
Marshfield
Hartville
Cabool
Rolla
Crocker
Dixon
Iberia
Versailles
Linn Creek
Camdenton
Osage Beach
Stover
Sedalia
Clinton
Harrisonville
Warsaw
Lebanon
Rolla
Springfield
Nevada
Fort Scott
Ottawa
Osage City
Burlington
Gordeer
Cole Camp
Camdenton
Houston
Cabool
Mountain Grove
Hartville
Marshfield
Buffalo
Dixon
Crocker
Iberia
Versailles
Waynesville
Fort Leonard Wood
Lake of the Ozarks

CONCLUSIONS

1. The rural characteristics of the Osage (Marais des Cygnes) and Gasconade River Basins are unlikely to be greatly changed in the foreseeable future. The recreational aspects of surface waters of the Basins will undoubtedly become of greater economic importance to the region.

2. Water resources are used primarily for municipal water supply, recreation, and livestock watering. Other valuable uses include hydroelectric power production, navigation, wildlife propagation, and the removal and ultimate disposal of waste products of urban communities and industries.

3. Pollution is discharged to the Osage (Marais des Cygnes) - Gasconade systems at 56*different locations. Prior to treatment the pollutional load is organically equivalent to that from approximately 98,000 people (76,000 from domestic sources and 22,000 from industrial operations). Waste equivalent to that from 11,900 people is discharged untreated to the streams. Treatment afforded by the facilities recommended for construction in the report will remove about 80 percent of the original pollutional material, an increase of about 23 percent over the present removal.

4. Damages from municipal pollution are largely local and have been further limited by an extensive sewage treatment program. The wide distance between waste outlets has allowed streams to be effectively utilized for assimilation of organic wastes without producing extensive damages to other water uses.

5. Several stream reaches in the Osage (Marais des Cygnes) Basin, formerly considered good fish habitat, are now virtually worthless for fishing due to the damaging effects of inorganic acid strip mine drainage.

6. Forty-two municipalities, or 95 percent of those having sewage collection systems, have plants capable of some degree of treatment. The high proportion of sewage treatment works to sewer systems indicates an extremely favorable attitude toward pollution abatement in the area.

7. Since extensive waste treatment facilities are already in existence, future need is largely that of increasing the effectiveness of existing treatment works and providing new works where needed. An adequate pollution control law would stimulate further reduction of pollution in the State of Missouri.

8. There is need for eight new municipal or institutional sewage treatment plants, eight new industrial waste treatment works, enlargement or additions to nine municipal treatment plants and one industrial plant, and the replacement of two municipal treatment works.

9. Benefits to be derived from additional pollution control and abatement will include increased protection for domestic water

*Three of the 44 sewered municipalities discharge waste through multiple outlets.

supplies, fish propagation, recreational developments, livestock watering, and aesthetic values. Little irrigation is practiced in the Basins; however, if in the future irrigation becomes increasingly popular, it too will be protected by pollution control measures.

10. Pollution of an interstate nature is restricted to acid mine drainage originating in Kansas which may possibly carry over into the State of Missouri.

RECOMMENDATIONS

It is recommended that:

1. Cities in Missouri avail themselves of the advantages offered by recent State legislation permitting financing of municipal sewage treatment works by revenue bonds and make necessary improvements as rapidly as possible.

2. Legal authority of the water pollution control agency of the State of Missouri be broadened in scope by legislative action to facilitate development and execution of a comprehensive water pollution control program.

3. The State water pollution control agencies of Kansas and Missouri intensify their efforts to bring information concerning pollution to the attention of the public.

4. Proper cognizance of the problem of sewage treatment works operation be given by State legislators and municipal authorities to insure adequate operation of sewage treatment works.

5. Periodic re-evaluation of stream conditions, as well as treatment plants, be made a part of the comprehensive program of the State water pollution control agencies.

6. The City of Nevada, Missouri, and the nearby State Hospital No. 3, now discharging raw sewage to the Marmaton River, take prompt action toward treatment of their wastes. New plants should also be provided for the following cities where some degree of sewage treatment already exists: Camdenton, Harrisonville, Osceola, Warsaw, Pleasant Hill, and Stockton, Missouri.

7. Obsolete plants located at Lyndon and Pleasanton, Kansas, be replaced.

8. Additional units, or the enlargement of existing units, be provided at the sewage treatment plants at Fort Scott and LaCygne, Kansas; Belton, Bolivar, Clinton, Eldorado Springs, Greenfield, and Newburg, Missouri.

9. Treatment be provided industrial waste now emanating from private outlets at the following locations: Rockville, Buffalo, Clinton,

Humansville, Osceola, Polk, and Stockton, Missouri. The meat packing industry at Lebanon, Missouri, should replace its present disposal unit with a new plant.

10. Improved waste treatment facilities be provided by the industrial establishment at Hartville, Missouri.

11. Acid mine waste in Henry, Johnson, Bates, Vernon, St. Clair, and Bartin County, Missouri, and in Bourbon and Crawford County, Kansas, be minimized through a program of improved mining practices.

GENERAL DESCRIPTION

Historical Background

The first white men - explorers, hunters, and trappers, - to view the region appeared during the 17th century. Father Marquette was among the most famous explorers to visit the area. He named the Osage River in his log as La Riviere de Grande Osages, in recognition of the Osage Indian Tribe who then dwelt on its banks. The upper reaches of the river became known as Le Maraias des Cygnes or "The Marsh of the Swans." The river is now officially named the Marais des Cygnes River from its headwaters to the point where it joins the Little Osage River, and the Osage River from there to its junction with the Missouri River.

In 1803 the drainage areas of the Osage (Marais des Cygnes) and Gasconade Rivers became part of the United States as a result of its inclusion in the Louisiana Purchase. Prior to that time the area was owned at various intervals by both France and Spain. Permanent settlers began to arrive in large numbers during the 1830s, consisting chiefly of southerners and European immigrants.

When Kansas was opened for settlement, both proslavery and abolitionist sympathizers made strenuous efforts to capture the new territory for their cause. Beginning in 1855 and lasting through the Civil War, the Basins were the scenes of internal strife and vicious guerilla warfare, which pitted neighbor against neighbor and left death and desolation in its wake.

John Brown of Kansas, martyr or madman, is remembered for the massacre at Pottawatomie Creek as well as a host of other incidents culminating in his attempted insurrection in Virginia. Quantrill and his "Red Leg Raiders" of Missouri were continually active burning, pillaging, looting, and killing. Jesse James and his band of outlaws began their operations in the west-central portion of the Osage (Marais des Cygnes) Basin. The wooded hills and rough terrain afforded them ample protection. Other armed forces, large and small, national and local in origin, have used the area both as a military base and a battlefield.

With the cessation of hostilities between the States, inhabitants of the Basins turned once more to their vocation - agriculture. The advent of the railroads inspired the rapid growth of new communities as well as enlargement of the older ones. These cities now serve primarily as service and transportation centers.

The history of the region is characterized by strong-willed men of intense and divergent beliefs, who would let little stand between them and implementation of their philosophies. Legends and folklore have lent additional color to this naturally picturesque region.

Physical Description

The Osage (Marais des Cygnes) River rises in east central Kansas, flows in a generally southeasterly direction to a point near Osceola, Missouri, where it bends and continues on a northeasterly course to its confluence with the Missouri River at Osage City, Missouri. The Osage (Marais des Cygnes) River is 496 miles long and drains an area of 15,300 square miles. The drainage Basin is roughly elliptical in shape, with the major axis approximately 250 miles in length, running in an east and west direction. The maximum width of the watershed is approximately 100 miles. Principal tributaries of the Osage (Marais des Cygnes) River are the Marmaton, Little Osage, Sac, Pomme de Terre, South Grand, and Niangua Rivers. (See table 12 - appendix A).

In its headwaters area, the Osage (Marais des Cygnes) Basin consists of gently rolling land surface which changes to the more rugged hilly formations of the foothills of the Ozark Mountains in its central and eastern portions. The land rises from an elevation of 500 feet above sea level at the mouth to about 1,250 feet at its source. The average slope from the mouth to Osceola, Missouri, is 0.74 feet per mile, then gradually increases to 5.20 feet per mile near its headwaters. The mean discharge of the Osage (Marais des Cygnes) River near St. Thomas, Missouri, draining an area of 14,500 square miles, is 10,450 cubic feet per second. Probable frequency of low mean monthly discharges are presented in table 13.

The Gasconade River rises in south central Missouri on the northern slopes of the Ozark Mountains, and flows in a northeasterly direction to its junction with the Missouri River at Gasconade, Missouri. The drainage area is 3,600 square miles and is roughly bottle shaped, with the neck of the bottle at its confluence with the Missouri River. The drainage basin is approximately 130 miles long and varies from 8 to 50 miles in width. The Gasconade River is 270 miles long. Its principal tributaries are Osage Fork, Roubidoux Creek, Big Piney Creek, and Little Piney Creek. (See table 12).

The land formations of the Gasconade Basin consist of rough, broken country in its headwaters area, rolling plateaus in its central portion, and increasingly hilly and broken land configurations near the Missouri River. The land elevations ascend from 492 feet above sea level at the mouth to about 1,200 feet at the source. The river slope varies from 1.2 feet per mile in its lower reaches to about 6 feet per mile near its source, and the mean discharge at Rich Fountain, Missouri, draining an area of 3,180 square miles, is 2,985 cubic feet per second. Table 14 depicts probable frequency of low mean monthly discharges.

The climate of the Osage (Marais des Cygnes) - Gasconade Basins is moderate. The mean annual temperature is approximately 55° F. with recorded extremes of 112° F. and -36° F. The average annual precipitation ranges from 36 inches in the west to 42 inches in the eastern

sector. Snowfall is light, averaging about 15 inches per year, with about 20 days of snow cover. The weather is characterized by moderate temperatures, fairly high winds, cyclonic disturbances, and violent storms having a high rate of rainfall.

Much of the hillier portion is covered with hardwood forests. Abundant pasture lands are found in the numerous small creek valleys.

Economic Development of the Osage (Marias des Cygnes) - Gasconade River Basins

The economy of the Osage (Marais des Cygnes) - Gasconade Basins is largely supported by agriculture and its related industries. The western one-third of the area contains the most favorable topographic and soil conditions for agriculture, and is the most prosperous. Principal crops are corn, wheat, hay, and forage. Dairy and poultry industries are well established and their produce is marketed principally in St. Louis and Kansas City, Missouri. Hardwood forests supply a valuable source of lumber.

Mineral resources, found primarily in Kansas, are oil, natural gas, and coal. Coal is also strip-mined in considerable quantity in the western tier of Missouri counties.

The tourist trade, largely attracted by the recreational potentials of the Lake of the Ozarks, has become a major industry. The Lake of the Ozarks was formed by Bagnell Dam, constructed in 1931 by the Union Electric Light and Power Company. In 1950 the Missouri Highway Commission surveyed highway usage in the vicinity of Lake of the Ozarks and therefrom estimated that 950,000 out-of-state visitors per year vacationed at the lake. It is unlikely that this figure represented more than 50 percent of the total number of visitors to the region. In addition to the recreational value of the reservoir, large quantities of hydroelectric power have been produced to supply the needs of industry within the Basin and throughout other sections of the State of Missouri.

Population of the Osage (Marais des Cygnes) - Gasconade Basins is approximately 425,000. Ottawa, Kansas, with population of 10,051 (1950 census) is the largest city. Other cities with populations over 5,000 are Fort Scott, Kansas, and Nevada, Clinton, and Lebanon, Missouri. Table 2 contains population data for municipalities. The cities and towns serve chiefly as marketing and distribution centers for agricultural products of surrounding areas. 1940 census indicated that the occupational distribution was as follows: 50 percent in agriculture; 26 percent in trade and transportation; 13 percent in manufacturing, construction, public utilities services, and mining, and the remaining 11 percent in professional and governmental services.

Population statistics also reveal that rural areas have experienced a steady decrease in population during the past two decades. However, cities and towns of 2,500 population and greater have shown increases during this same period. The influence of recreational development is seen by the fact that towns and cities favorably located and directly affected by tourist trade gained as much as

Table 2. Osage (Marais des Cygnes) - Gasconade River Basins - Population of cities

Municipality[1]	Population - U. S. Census 1920	1930	1940	1950
Kansas				
Arcadia	1,175	985	843	572
Arma	2,180	2,004	1,615	1,334
Baldwin	1,137	1,127	1,096	1,737
Blue Mound	570	545	449	424
Bronson	530	450	421	415
Burlingame	1,330	1,127	1,019	1,009
Carbondale	383	399	415	453
Eskridge	759	726	648	601
Fort Scott	10,693	10,763	10,657	9,992
Gardner	514	493	514	676
Garnett	2,329	2,768	2,607	2,693
Greeley	496	503	387	436
Kincaid	443	380	401	309
LaCygne	1,028	1,019	932	794
Louisburg	556	616	590	677
Lyndon	732	742	751	729
Moran	676	651	592	616
Mound City	720	655	703	707
Mulberry	2,697	1,596	1,175	779
Osage City	2,376	2,402	2,097	1,912
Osawatomie	3,293	4,480	4,145	4,334
Ottawa	9,018	9,562	10,193	10,051
Paola	3,238	3,762	3,511	3,971
Pleasanton	1,291	1,214	1,227	1,168
Quenemo	733	564	557	391
Richmond	400	411	418	433
Scranton	622	538	500	487
Spring Hill	555	566	489	619
Waverly	619	593	514	487
Wellsville	756	709	634	729
Williamsburg	404	367	365	297
Missouri				
Adrian	955	934	868	905
Amoret	390	344	328	355
Appleton City	1,262	1,136	1,188	1,150
Ash Grove	1,000	1,107	1,101	970
Belton	899	992	971	1,226
Bolivar	1,980	2,256	2,636	3,452
Buffalo	915	835	920	1,199
Butler	2,702	2,706	2,985	3,328
Cabool	905	908	1,069	1,234
Calhoun	603	501	521	463
Camdenton	-	-	893	1,139
Chilhowee	469	414	415	335
Clinton	5,098	5,744	6,041	6,069
Cole Camp	589	932	753	813
Conway	546	576	516	514
Crocker	506	522	453	712
Deepwater	1,391	1,093	956	885
Dixon	810	721	741	988
Drexel	543	553	450	456
Eldorado Springs	2,217	1,917	2,342	2,612

Municipality	Population - U. S. Census 1920	1930	1940	1950
Missouri (Cont'd)				
Everton	463	368	368	306
Fair Play	486	454	431	383
Freeburg	292	436	395	370
Freeman	295	279	302	309
Garden City	711	632	599	590
Gasconade	-	375	494	448
Greenfield	1,440	1,304	1,353	1,212
Harrisonville	2,073	2,306	2,322	2,530
Hartville	521	453	393	586
Houston	772	690	820	1,270
Husamsville	947	1,092	786	803
Hume	542	595	487	474
Iberia	487	539	486	595
Lebanon	2,848	3,562	5,025	6,752
Liberal	1,160	848	771	739
Licking	-	-	598	733
Lincoln	345	338	375	316
Linn Creek	431	553	202	162
Lockwood	967	823	841	791
Lowry City	509	549	488	493
Marshfield	1,371	1,378	1,764	1,943
Meta	426	422	381	353
Montrose	715	531	487	518
Morrisville	425	340	389	296
Mountain Grove	2,212	2,229	2,431	3,104
Nevada	7,139	7,448	8,181	7,986
Newburg	1,235	1,036	1,056	949
Osceola	1,025	1,043	1,190	1,081
Pleasant Hill	1,965	2,330	2,118	2,195
Republic	1,097	841	790	965
Rich Hill	2,261	2,118	1,994	1,820
Richland	955	945	985	1,133
Rockville	486	408	336	372
Schell City	596	413	454	400
Sheldon	544	456	463	427
Stockton	696	647	801	811
Urich	538	507	465	400
Vienna	-	348	433	471
Walnut Grove	403	387	310	347
Warsaw	925	1,102	957	939
Waynesville	293	392	468	1,010
Vesubleau	413	421	439	432
Westphalia	234	432	374	319
Windsor	2,034	1,879	2,373	2,422

[1]Cities listed have either a population of 300 or more or a municipal water or sewage system.

20 percent in population during the past 10 years (1940-1950). However, since a relatively small area is directly influenced by the tourist industry, it may be expected that population trends of the Basins will continue downward during the next few years.

Transportation and communication facilities are good. Six major railroad lines and many Federal, State, and County highways traverse the region.

USES OF WATER RESOURCES

Water resources of the Osage (Marais des Cygnes) - Gasconade Basins are used extensively for domestic water supplies, game fishing, and other recreational purposes, support of wildlife, hydroelectric power, limited navigation, and for the removal and ultimate disposal of domestic and industrial wastes.

The headwaters of the Osage (Marais des Cygnes) River serve numerous domestic water supplies. Approximately 45,000 people are supplied from impounding reservoirs or directly from streams of the Osage (Marais des Cygnes) River system. One supply is taken from Big Piney Creek in the Gasconade Basin. Table 3 lists municipalities using surface water together with details pertinent to the supply. Communities deriving their water supply from ground sources, usually by means of deep wells, are listed in table 4.

Development of the Lake of the Ozarks has resulted in extensive recreational use of water resources. Each year nearly two million people enjoy fishing, boating, swimming, and other water sports now available to them at the Lake of the Ozarks. Streams of the Basins have always supported an extensive sport fishery, and this use was enhanced by development of the large reservoir. The waterways also afford resting place for large flocks of migratory birds, and provide an ideal habitat for numerous small game terrestial animals.

Available pasture land has been conducive to production of large numbers of livestock whose water supply is obtained principally from streams.

Hydroelectric power is produced in quantity by the Union Electric Light and Power Company at Bagnell Dam. Several other sites yet undeveloped have hydroelectric power potentialities.

Navigation is limited to small power boats and pleasure craft which operate for a short distance in the main stems of both the Osage (Marais des Cygnes) and Gasconade Rivers above their respective junctions with the Missouri River, and on the Lake of the Ozarks.

Streams and creeks of the Basins are of necessity used quite extensively for ultimate disposal of waste products from industry and populated places.[1]

[1] Includes incorporated or unincorporated municipalities, other legal bodies as towns, significant institutions, resorts, recreational centers, and other population centers.

Table 3. Osage (Marais des Cygnes) - Gasconade River Basins - Municipal water supplies from surface sources

Municipality and location	Source	Treatment[1]	Estimated population served	Average consumption M. G. D.[2]
Burlingame, Kansas	Dragon Creek	ADF	950	0.10
Fort Scott, Kansas	Marmaton River	C/H	10,000	1.60
Garnett, Kansas	Cedar Creek and Lakes	ADF	2,200	0.34
Lyndon, Kansas	Salt Creek	DF	600	0.04
Norton, Kansas	Lakes	ADF	500	0.03
Mound City, Kansas	Little Sugar Creek	DF	650	0.02
Osage City, Kansas	Imp. Res.	ADF	1,900	0.10
Osawatomie, Kansas	Osage River (Marais des Cygnes)	DFH	4,000	0.65
Ottawa, Kansas	Osage River (Marais des Cygnes)	DFH	8,600	0.96
Paola, Kansas	Bull Creek	DF	3,500	0.22
Pleasanton, Kansas	Imp. Res.	DF	1,200	0.08
Spring Hill, Kansas	Little Bull Creek, East Branch	DF	-	-
Adrian, Mo.	Imp. Res.	ADF	350	0.02
Butler, Mo.	Miami Creek	DF	2,800	0.183
Clinton, Mo.	South Grand River	DF	4,200	0.20
Fort Leonard Wood, Mo.	Big Piney Creek	FD	-	-
Harrisonville, Mo.	Imp. Res.	ADF	2,300	0.170
Lakeside, Mo.	Lake of the Ozarks and Spring	FD	125	-
Pleasant Hill, Mo.	Imp. Res.	ADF	1,300	0.075

[1]Treatment - A - Aerated
D - Chlorinated
F - Coagulated, settled, filtered
H - Softened

[2]M. G. D. - Million gallons daily

Table 4. Osage (Marais des Cygnes) - Gasconade River Basins - Municipal water supplies from ground sources

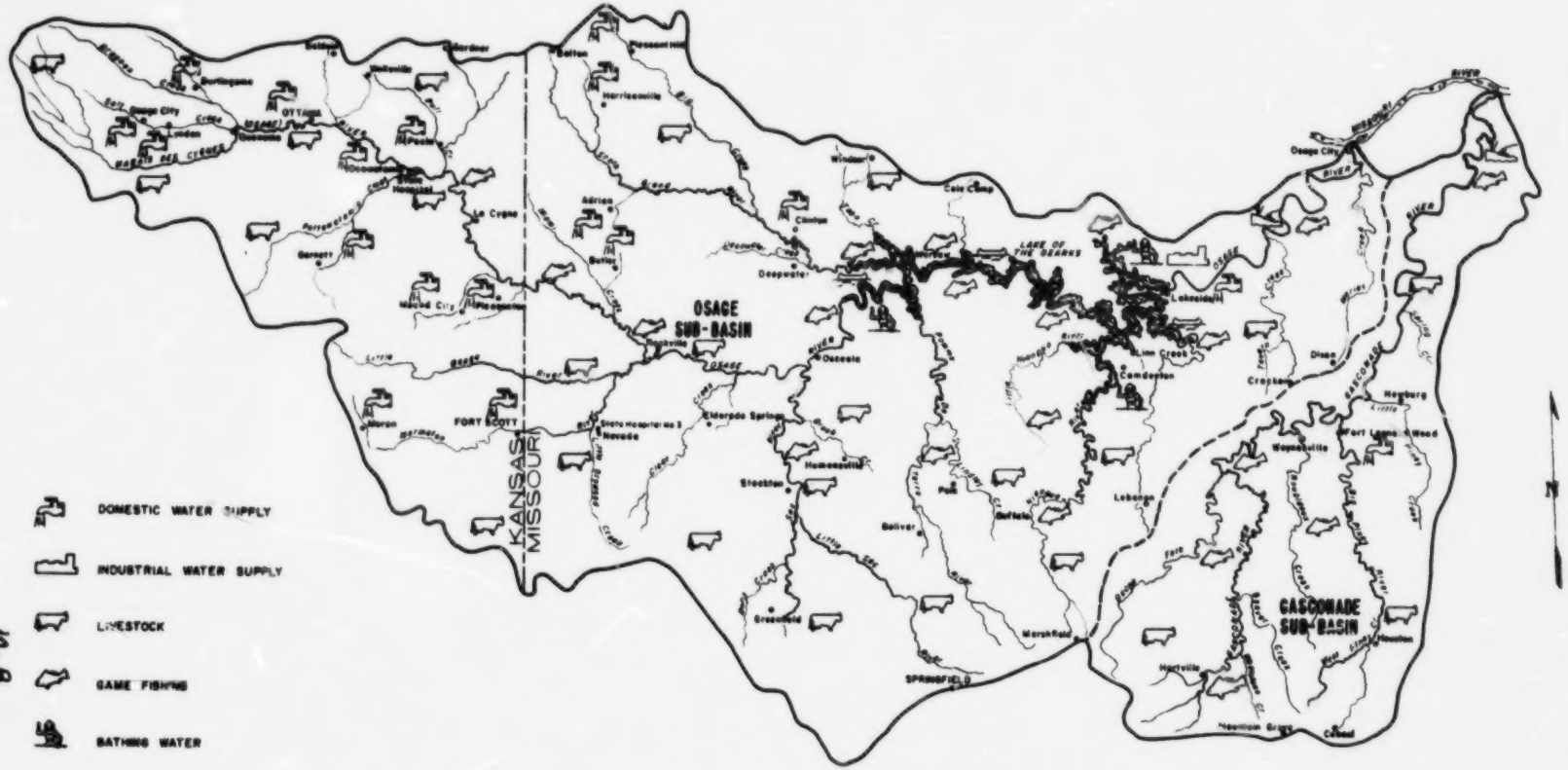
Municipality	State	Source[1]	Treatment[2]	Estimated population served	Average consumption M. G. D.[3]
OSAGE (MARAIS DES CYGNES) RIVER BASIN					
Arcadia	Kansas	DW	ADF	600	0.06
Arma	Kansas	DW	ADF	1,200	0.04
Baldwin	Kansas	SW	D	1,100	0.07
Gardner	Kansas	SW	D	600	0.02
LaCygne	Kansas	SW	D	500	0.02
Lane	Kansas	DW	D	235	-
Mulberry	Kansas	DW	AF	1,000	0.05
Quenemo	Kansas	DW	H	350	0.01
Reading	Kansas	SW	DF	200	0.01
Waverly	Kansas	DW	H	1,000	0.05
Wellsville	Kansas	SW	D	700	0.02
Appleton City	Missouri	DW	H	500	0.035
Ash Grove	Missouri	DW	H	150	0.030
Belton*	Missouri	DW	D	730	0.025
Bolivar	Missouri	DW	H	2,400	0.150
Buffalo	Missouri	DW	H	870	0.010
Camdenton	Missouri	DW	H	700	0.050
Cole Camp	Missouri	DW	H	450	0.010
Crocker	Missouri	DW	H	250	0.006
Deepwater	Missouri	DW	H	400	0.005
Dixon	Missouri	DW	H	1,000	0.025
Eldorado Springs	Missouri	DW	H	1,300	0.060
Fair Play	Missouri	DW	H	290	0.008
Greenfield	Missouri	DW	D	700	0.075
Humansville	Missouri	DW	H	600	0.030
Lebanon	Missouri	DW	D	4,700	0.375
Liberal	Missouri	DW	A	450	0.025
Linn Creek	Missouri	DW	H	120	0.015
Lockwood	Missouri	DW	D	720	0.035
Marshfield	Missouri	DW	H	1,200	0.300
Nevada	Missouri	DW	AD	7,400	0.340
Osceola	Missouri	DW	H	1,000	0.030
Republic	Missouri	DW	D	680	0.040
Rich Hill	Missouri	DW	H	1,500	0.056
Stockton	Missouri	DW	H	800	0.018
Walnut Grove	Missouri	DW	H	260	0.008
Warsaw	Missouri	DW	H	800	0.024
Windsor	Missouri	DW	H	2,000	0.090
GASCONADE RIVER BASIN					
Cabool	Missouri	DW	H	1,000	0.100
Gasconade	Missouri	DW	H	100	0.308
Houston	Missouri	DW	H	600	0.012
Licking	Missouri	DW	H	480	0.018
Mountain Grove	Missouri	DW	H	1,450	0.050
Newburg	Missouri	DW	H	500	0.065
Richland	Missouri	DW	H	985	0.090
Waynesville	Missouri	DW	H	5,000	0.150

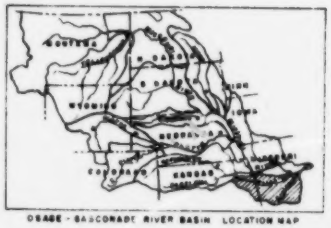
[1]Source - DW - Deep Well
SW - Shallow Well

[2]Treatment - H - None
A - Aerated
D - Chlorinated
F - Coagulated, Settled, Filtered
H - Softened

[3]M. G. D. - Million gallons daily

* Also from Kansas City, Missouri





OSAGE - GASCONADE RIVER BASIN LOCATION MAP

Scale

10 5 0 10 20 30 40 miles

OSAGE - GASCONADE RIVER BASIN

EXISTING PRIMARY WATER USES

MAP NO. 2

Surface water resources have been used relatively little for industrial water supplies or for irrigation. Industry located in the area has been of a type which requires very little water in its operations. Water usage is expressed pictorially on map No. 6.

POLLUTION CONTRIBUTED TO WATER RESOURCES

Forty-four municipalities and nine separately sewered industries discharge waste into the Osage (Marais des Cygnes) - Gasconade River systems. Municipal sewer systems serve approximately 76,000 people and numerous small industries, which contribute organic waste with an additional population equivalent of 16,000. Nine separately sewered industries contribute waste equivalent in organic content to a population of about 6,000 people.

Extensive sewage treatment has been practiced in this area for many years. At the present time treated and untreated waste discharged to streams is estimated to be equivalent to that produced by 42,000 people.

About 28 percent of the organic wastes reaching streams, or a population equivalent of 11,900 is discharged without treatment. The untreated wastes emanate from two domestic and six industrial sources, all located in the State of Missouri. The industrial waste load is discharged in widely separated areas and in relatively small quantities. The industrial waste is mostly organic material originating from milk processing, canning, and meat or poultry packing establishments.

Strip-mine drainage[1] has affected approximately 170 miles of stream reaches in the Missouri portion of the Osage (Marais des Cygnes) River Basin. Some streams contain virtually no aquatic life because of acid wastes from strip mines. Tebo Creek in Henry and Johnson Counties; Marshall, Dillon, Dumpling, Sparrow and Deepwater Creeks in Henry County; Monegaw and Cooper Creeks in St.Clair County; Clear Creek, Willow Branch, Robinson, Drywood, and Big Drywood Creek in Vernon County; Big Drywood Creek in Barton County; Walnut Creek and Marais des Cygnes River in Bates County, Missouri, are polluted with acid mine waste. Acid mine waste is also reportedly affecting fish life in the streams of northern Crawford County and southern Bourbon County, Kansas.

Fort Leonard Wood, a military establishment within the Gasconade Basin, does not have a fixed population, therefore it is difficult to estimate the amount of domestic pollution it contributes. The camp is equipped, however, with facilities capable of a high degree of treatment.

Sources of municipal and industrial pollution are indicated on maps No. 2 and 3, other pertinent data are shown in tables 5 and 6.

Many cities are not completely sewered and only about 50 percent of the municipalities of over 300 population have sanitary sewer systems. Less than 75 percent of the urban[2] population is served by public sewer systems.

[1]Strip-mine Pollution in Missouri Streams by H. J. Fisher, Biologist, Missouri Conservation Commission.

[2]Municipalities having populations of 300 people or more.

Table 5. Osage (Marais des Cygnes) - Gasconade River Basins - Basic data on sources of municipal pollution

Name and location of municipality	Population served by sewers P.E.	Estimated untreated waste P.E.	Treatment provided	Adequacy of treatment Cap'y	Oper.	Estimated P.E. Discharged to watercourse	Project needs	Current status of community action
Osage River (Marais des Cygnes)								
Quenemo, Kans.	400	400	S	Sat.	Unsat.	200	None	
Salt Creek								
Osage City, Kans.	1,400	1,400	S	Sat.	Sat.	350	None	
Lyndon, Kans.	600	600	S	Unsat.	Unsat.	300	E	Inactive
Dragoon Creek								
Burlingame, Kans.	950	950	S	Sat.	Sat.	200	None	
Ottawa, Kans.	10,000	10,000	S	Sat.	Sat.	2,500	None	
Ottawa Creek								
Baldwin, Kans.	1,200	1,200	S	Sat.	Sat.	120	None	
Osawatomie State Hospital Kansas	2,000	2,000	S	Sat.	Sat.	300	None	
Pottawatomie Creek								
Garnett, Kans.	2,000	2,000	S	Sat.	Sat.	500	None	
Osawatomie, Kans.	3,800	3,800	S	Sat.	Sat.	1,100	None	
Bull Creek								
Gardner, Kans.[3]								
Wellsville, Kans.	600	600	S	Sat.	Sat.	150	None	
Paola, Kans.	3,200	3,200	S	Sat.	Sat.	1,200	None	
LaCygne, Kans.	700	700	P	Unsat.	Unsat.	500	A	Inactive
Muddy Creek								
Pleasanton, Kans.	1,000	1,000	S	Unsat.	Unsat.	500	E	Inactive
Miami Creek								
Grand Mont Creek								
Butler, Mo.	2,100	2,850	S	Sat.	Sat.	1,000	None	
Little Osage River								
Marmaton River								
Moran, Kans.[3]								
Fort Scott, Kans.	10,000	11,000	S	Unsat.	Sat.	3,000	A	Final plans approved
Nevada, Mo.	5,200	5,830	E	-	-	5,830)		
State Hospital #3[1]	2,400	2,400	E	-	-	2,400)	2-EP	Final plans approved
Clear Creek								
Walnut Creek								
Nevada, Mo.	860	3,360	P	Unsat.	Sat.	2,180	A	Final plans approved
Sac River								
Jones Creek								
Greenfield, Mo.	780	1,032	2-P	Unsat.	Sat.	760	2-A	Inactive
Little Sac River								
Springfield, Mo.	5,800	5,800	S(EW Pl)	Sat.	Sat.	290	None	
Stockton Branch								
Stockton, Mo.	100	100	P	Unsat.	Sat.	75	EP	Inactive
Osage River								
Osceola, Mo.	500	550	Septic	Unsat.	Unsat.	375	EP	Inactive
Fresne de Terre River								
Town Branch								
Bolivar, Mo.	1,977	5,977	S	Unsat.	Sat.	2,840	E	Final plans approved
South Grand River								
East Creek								
Bolton, Mo.	800	800	S	Unsat.	Sat.	240	E	Inactive
Bear Branch								
Harrisonville, Mo.	1,600	1,600	P	Unsat.	Sat.	1,120	EP	Inactive
Big Creek								
Pleasant Hill, Mo.	1,510	1,510	P	Unsat.	Sat.	1,133	EP	Inactive
South Grand River								
Clinton, Mo.	3,740	3,740	P	Unsat.	Sat.	2,680	E	Inactive
Deepwater Creek								
Deepwater, Mo.	400	400	S	Sat.	Sat.	40	None	
Tebo Creek								
West Branch								
Windsor (W), Mo.	1,900	2,390	S	Sat.	Sat.	240	None	
Windsor (E), Mo.	100	660	S	Sat.	Sat.	110	None	
Warsaw, Mo.	660	812	Septic	Unsat.	Unsat.	609	EP	Inactive
Cole Camp Creek								
Cole Camp, Mo.	300	300	S	Sat.	Sat.	30	None	
Blackwater River								
Marshfield, Mo.	900	1,998	S	Sat.	Sat.	600	None	
Candenton, Mo. (Ro. Pl.)[2]	40	40	Septic	Unsat.	Unsat.	30)		
Lina Creek						)	EP	Final plans approved
Candenton, Mo. (Ro. Pl.)[2]	40	40	Septic	Unsat.	Unsat.	30)		
Lina Creek	145	145	S	Sat.	Sat.	15	None	
Grand Glaize River								
Lebanon, Mo.	2,300	4,600	S	Sat.	Sat.	1,400	None	
Lakeside, Mo.	125	125	P	Sat.	Sat.	100	None	
Tavern Creek								
Crocker, Mo.	250	250	S	Sat.	Sat.	25	None	
Maries Creek								
Vienna, Mo.	400	400	S	Sat.	Sat.	40	None	
Gasconade River								
Woods Fork								
Whetstone Creek								
Mountain Grove, Mo.	1,200	2,130	S	Sat.	Sat.	210	None	
Roubidoux Creek								
Waynesville, Mo.	800	800	S	Sat.	Sat.	80	None	
Big Piney Creek								
Dixon, Mo.	1,200	3,000	S	Sat.	Sat.	450	None	
Grand Glaize River								
Brushy Creek								
Houston, Mo.	800	800	S	Sat.	Sat.	80	None	
Big Piney Creek								
Fort Leonard Wood	Unk.	Unk.	S	Sat.	Sat.	Unk.	None	
Little Piney Creek								
Roseburg, Mo.	150	150	P	Unsat.	Sat.	100	A	Inactive

Note: P - Primary treatment including septic tanks
S - Secondary
E - No treatment
A - Additions
E - Enlargement
E - Replacement
EP - New Plant
Unsat - Unsatisfactory: Sat - Satisfactory

[1] To be served by Rosendo sewage treatment plant.
[2] Population of Town of Candenton greatly exceeds population served.
[3] New sewer systems and treatment facilities under construction at Moran and Gardner, Kansas. Not yet included as sources of pollution.

Table 6. Osage (Marais des Cygnes) - Gasconade Sub-Basins - Basic da , on sources of industrial pollution - Outlet separate from municipal syste

Name and location	Type of industry	Type of waste produced	Treatment or other pollution control measures: Degree	Treatment or other pollution control measures: Adequacy	Population equivalent discharged to watercourse	Pollution abatement measures needed	Project status
Osage River							
Sac River							
Little Sac River							
Stockton Branch							
Cheese Plant Stockton, Mo.	Food & kindred products	Organic	None	Inadequate	1,040	New plant or other control measures	Inactive
Osage River							
Cheese Plant Rockville, Mo.	Food & kindred products	Organic	None	Inadequate	160	New plant or other control measures	Inactive
Cheese Plant Osceola, Mo.	Food & kindred products	Organic	None	Inadequate	1,400	New plant or other control measures	Inactive
Pomme de Terre							
Lingley Creek							
Panther Creek							
Cannery, Polk, Mo.	Food & kindred products	Organic	None	Inadequate	340	New plant or other control measures	Inactive
Cheese Plant Humansville, Mo.	Food & kindred products	Organic	Minor	Inadequate	800	New plant or other control measures	Inactive
Osage River							
South Grand River							
Meat Packing Plant Clinton, Mo.	Food & kindred products	Organic	None	Inadequate	480	New plant or other control measures	Inactive
Osage River							
Niangua River							
Cheese Plant Buffalo, Mo.	Food & kindred products	Organic	None	Inadequate	720	New plant or other control measures	Final plans approved
Grand Glaize River							
Meat Packing Plant Lebanon, Mo.	Food & kindred products	Organic	Partial	Inadequate	550	New plant or other control measures	Inactive
Gasconade River							
Woods Fork Branch							
Cheese Plant Hartville, Mo.	Food & kindred products	Organic	Partial	Inadequate	450	Enlargement	Inactive

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DAMAGES TO WATER RESOURCES FROM POLLUTION

Damages from extensive organic pollution in the streams of the Osage (Marias des Cygnes) - Gasconade Basins are largely historical, although at certain points localized damages are still apparent. The development of pollution control in the Basins has followed a rather definite pattern. As cities and villages grew, sewage began to pollute streams causing nuisance conditions immediately below outfalls. These conditions were not long tolerated by the State water pollution control agencies and local citizens, both usually bringing pressure to bear upon municipalities to build treatment works.

Currently, damages to property, livestock watering, and fishing are being experienced below Nevada, Missouri. Waste from the Kraft Cheese Company plant at Hartville, Missouri, is causing extensive damage to livestock watering, and fishing in Woods Fork River in the Gasconade Basin. Localized damages occur in streams receiving wastes from Greenfield, Stockton, Eldorado Springs, and Bolivar, Missouri. Fishing and livestock watering are the principal water uses affected by these sources of pollution.

The damaging effects of pollution on public water supplies taken from streams of the Basins are difficult to ascertain. It is reported by representatives of the Kansas Board of Health that taste and odor problems occur in surface water supplies. They conclude, however, that the tastes and odors are probably caused by natural pollution. The high degree of sewage treatment prevailing has undoubtedly prevented much more serious damage.

Damage by pollution in waters used for recreation, other than fishing, have been almost nil, but mine waste is reported to be extensive in 16 stream reaches aggregating more than 170 miles of the Osage (Marais des Cygnes) Basin waterways. Fish kills from acid mine waste have been reported in almost all of these reaches. These streams, once considered good fish habitats, are now practically devoid of aquatic life.

BENEFITS RESULTING FROM POLLUTION PREVENTION AND ABATEMENT

Benefits from pollution prevention and abatement accruing to water users in the Basins are many and varied. The protection afforded a public water supply is an example of a benefit which is readily delineated. Three of the larger municipalities are at the present time deriving their water directly from a flowing stream which might be adversely affected by unabated pollution from upstream sources. In addition to the three larger municipalities, 15 other communities obtain their water supplies from surface sources. In most instances the sources of supply for the latter communities are rather remote from municipal and industrial pollution, however they must still be protected against pollution arising from use of the watershed by picnickers, campers, resort installations, and others.

Protection of the recreational value of streams and lakes is exceedingly important because of the extensive prevailing use. Fishing,

bathing, and other water sports depend on clean water. By preventing pollution of waters of the highly developed recreational areas, considerable monetary benefits are virtually assured on capital invested in the developments.

Fishing is particularly vulnerable to inroads of pollution. Income realized from the sale of fishing licenses, equipment, and the numerous other expenditures associated with traveling and lodging is large and is becoming increasingly important to the economy of the region and to the State of Missouri. Abatement of both organic and inorganic pollution would result in increasing numbers of stream reaches in which fishing would be available to the sports enthusiasts.

A large and profitable dairy industry has been built up in the Osage (Marais des Cygnes) - Gasconade region and considerable dependence is placed on streams to supply water for dairy herds. Protection of waters used for watering livestock benefits the dairy industry in several ways, the most important of which are: (1) preventing economic loss resulting from disease in dairy animals contracted from drinking water containing waste inimical to stock health, and (2) by reducing monetary loss from insanitary dairy products. Dairy cows standing or wading in sewage-ladened waters become contaminated, and unless very painstaking and time-consuming cleaning operations are employed, milk obtained from such animals is likely to be contaminated.

One of the most important but less tangible aspects of pollution control is the aesthetic value of a clean stream. It is difficult to assess a monetary value on the aesthetic, however this in no way diminishes from its importance. It is axiomatic that when a man's surroundings are pleasant and healthful he tends toward longer and more productive life. Clean streams contribute much to the improvement of a man's environment.

If the treatment recommended in the report is placed in operation, pollution will be reduced to a point where it can be assimilated by the streams without detrimental effects.

POLLUTION CONTROL MEASURES IN EFFECT

There are several positive factors which have been responsible for providing the Osage (Marais des Cygnes) - Gasconade River Basins with its present high degree of pollution control. The dominant ones have been the activities of the water pollution control agencies of the States of Missouri and Kansas, and local citizenry who are unwilling to allow the rampant destruction of their streams by unabated pollution.

In Kansas the State Board of Health has been given responsibility for control of stream pollution by the State Legislature. Efforts to reduce pollution have been markedly successful. The Missouri State Division of Health has major responsibility for stream pollution control for the State of Missouri, and has accomplished much without benefit of adequate legislation for enforcing antipollution measures.

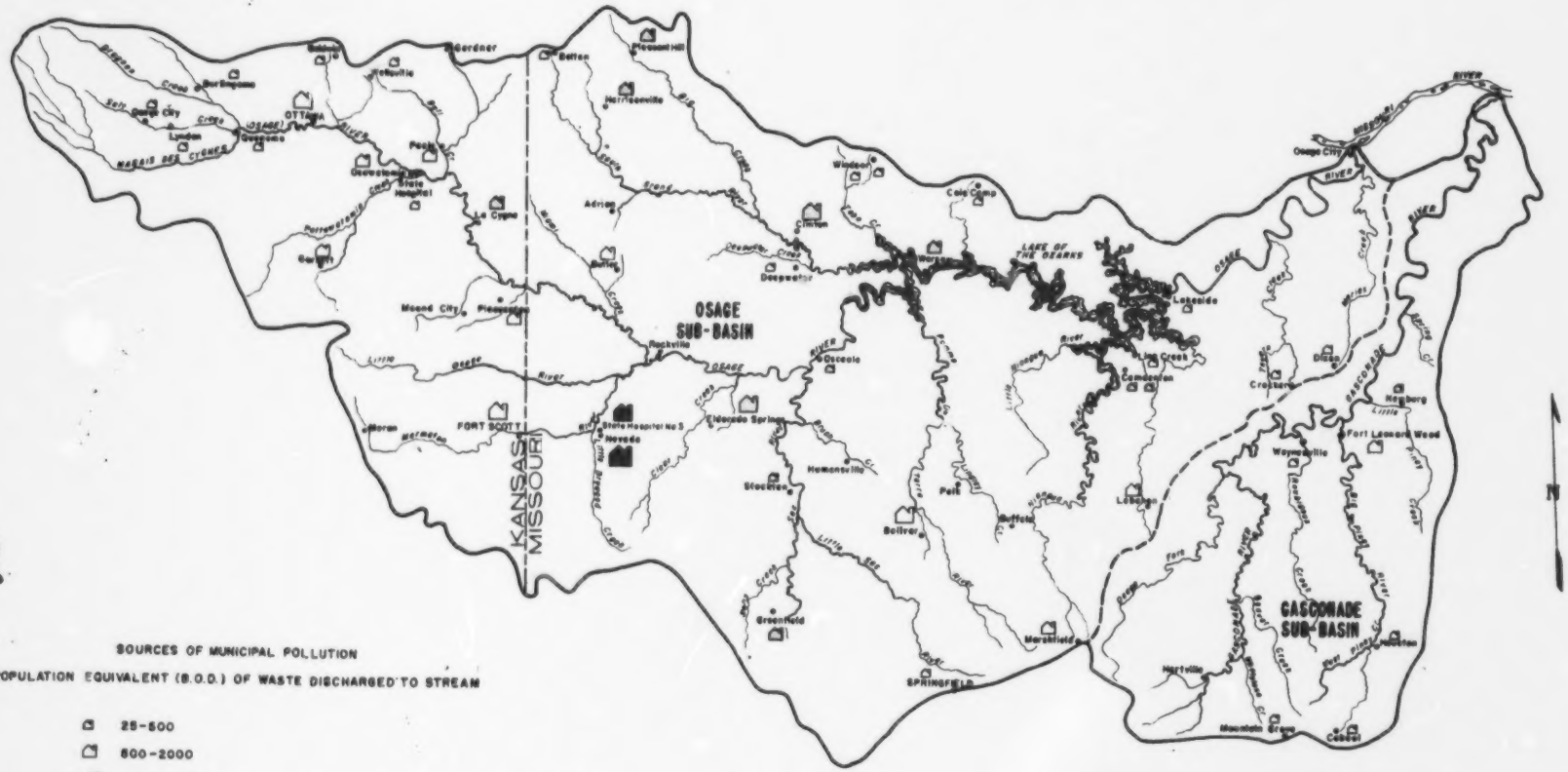
The State agencies exercise control over construction of treatment works by requiring plans and specifications for structures to be submitted for approval. This action has resulted in the building of works adequate to meet needs. It is necessary in the State of Kansas to obtain a permit prior to discharge of any industrial or domestic waste to any stream. By means of this system it is possible for the State agency to be informed of new sources and types of wastes and to require adequate treatment prior to discharge into watercourses.

A large measure of present control can be attributed to educational programs instituted by the State public health agencies. The effects of pollution have been discussed with many local groups. Operators of sewage treatment works have been kept constantly informed concerning new methods of treatment, and improvements in older methods. It has been a practice in Kansas to maintain three-day training schools for the benefit of sewage plant operators. In Missouri, district conferences of sewage treatment plant operators are being conducted at more frequent intervals, in a concerted effort to raise the general leval of operation of sewage treatment works. Both State pollution control agencies plan regular visits to each treatment works at which time plants are inspected and reports of their condition are prepared for submission to municipal officials. In addition, the control agency of Kansas has recently inaugurated a program to supplement plant inspections with laboratory investigation of stream conditions, using a mobile laboratory.

At the present time 42 municipalities have sewage treatment facilities. Only two domestic sources of pollution, Nevada, Missouri, and the nearby State Hospital, still discharge untreated wastes to streams of the Basins. Only one Kansas municipality does not have secondary treatment. Three of the nine sources of industrial wastes provide some degree of treatment. Maps No. 2 and 3 illustrate the location of sewage and waste treatment plants in the Basins. Tables 7 and 8 summarize the type of treatment and its adequacy.

Many of the treatment works in operation today were constructed 20 to 30 years ago and have served the communities well. Continuous growth of municipalities, however, has overtaxed some facilities to a point where efficiency of operation has been seriously reduced.

The need to protect the recreational value of the Lake of the Ozarks was recognized at a very early date, and a program of control was established in 1931 by the Missouri Division of Health. Because of this policy at the beginning of the development, potential pollution from thousands of residential and resort homes along the 1,300 mile shoreline of the Lake has never affected the recreational value of the lake waters. The policy, still in force, consists of requiring all resort or residential structures served by water-carried sewage to construct treatment facilities, the effluent from which must be discharged to the soil through an absorption system.


OSAGE SUB-BASIN
GASCONADE SUB-BASIN
KANSAS
MISSOURI
Lake of the Ozarks
Osage River
Gasconade River
Osceola
Nevada
Fort Scott
Springfield
Marshfield
Bolivar
Stockton
Camdenton
Lebanon
Waynesville
Ft. Leonard Wood
Hermitage
Cedar Creek
Deepwater
Clinton
Warsaw
Harrisonville
Butler
Pleasanton
Paola
Ottawa
Osawatomie
Garnett
Iola
Chanute
Erie
Girard
Pittsburg
Columbus
Parsons
Oswego
Independence
Coffeyville
Baxter Springs
Joplin
Carthage
Neosho
Aurora
Mt. Vernon
Lamar
Nevada
Rich Hill
Butler
Adrian
Le Cygne
Mound City
Pleasanton
Paola
Osawatomie
State Hospital
Ottawa
Garnett
Iola
Chanute
Erie
Girard
Pittsburg
Columbus
Parsons
Oswego
Independence
Coffeyville
Baxter Springs
Joplin
Carthage
Neosho
Aurora
Mt. Vernon
Lamar
Rich Hill
Harrisonville
Belton
Gardner
Olathe
Edgerton
Prairie City
Baldwin
Lawrence
Eudora
Perry
Meriden
Topeka
Silver Lake
Rossville
Wamego
St. Marys
Alma
Burlingame
Osage City
Lyndon
Scranton
Carbondale
Overbrook
Quenemo
Richmond
Princeton
Ottawa
Garnett
Greeley
Wellsville
Ottawa
Osawatomie
Paola
Pleasanton
Mound City
Le Cygne
Adrian
Butler
Rockville
Deepwater
Clinton
Windsor
Warsaw
Cole Camp
Lake of the Ozarks
Osage River
Gasconade River
Osceola
Nevada
Fort Scott
Springfield
Marshfield
Bolivar
Stockton
Camdenton
Lebanon
Waynesville
Ft. Leonard Wood
Hermitage
Cedar Creek
Deepwater
Clinton
Warsaw
Harrisonville
Butler
Pleasanton
Paola
Ottawa
Osawatomie
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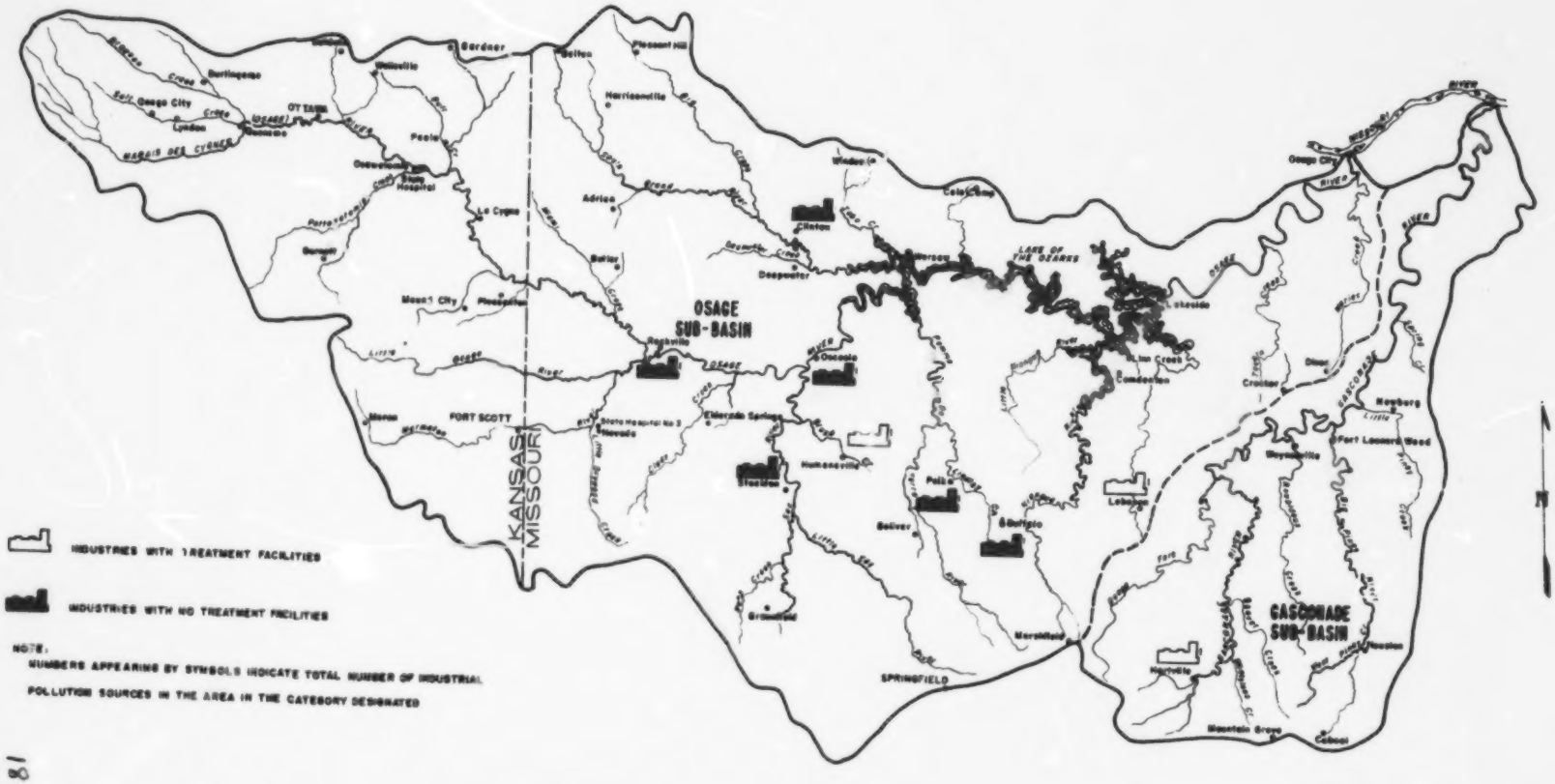

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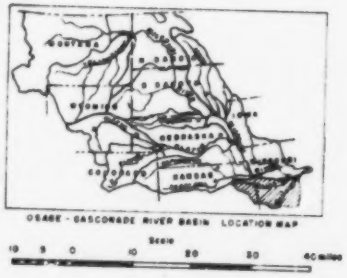


OSAGE - GASCONADE RIVER BASIN
SOURCES OF INDUSTRIAL POLLUTION AND EXISTING TREATMENT FACILITIES

MAP NO. 4

Table 7. Osage (Marais des Cygnes) - Gasconade River Basins - Statistical summary of existing treatment facilities - Municipal

Degree of treatment provided	Number		Population served
	Municipalities*	Plants	
Primary	12	14***	10,805
Secondary	30**	31	57,922
No treatment	2	-	7,600
TOTAL	44	45	76,32[illegible]

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, towns, significant institutions, resorts, recreational centers or other population centers.

**Includes one plant for which 'population served' is unknown.

***Includes 4 septic tanks.

Table 8. Osage (Marais des Cygnes) - Gasconade River Basins - Adequacy of existing treatment facilities - Municipal and industrial

Existing treatment facilities	Number	Adequacy with relation to:					
		Capacity			Operation		
		Satisf.	Unsatisf.	Undetermined	Satisf.	Unsatisf.	Undetermined
Municipal*	45	26	19	0	37	8	0
Industrial**	3	0	3	0	0	3	0

*Includes incorporated or unincorporated municipalities, other legal bodies as sanitary districts, towns, significant institutions, resorts, recreational centers or other population centers.

**Industries having separate outlets discharging wastes directly to watercourse.

POLLUTION PREVENTION MEASURES NEEDED

Present water uses and increased or additional uses possible with improved water quality, together with protection of water rights and property values, largely determine the pollution prevention measures needed. The objective of water pollution control programs is to preserve or reclaim water to best serve these interests. Treatment requirements, like other aspects of water resources development, are generally influenced by economic consideration. In addition, the intangible aspects of moral obligation, aesthetic values, and nuisance conditions exert a powerful and positive influence on the justification of waste treatment facilities.

Water quality objectives have been fairly well developed for such water uses as domestic and industrial water supply, recreation, bathing, and supporting fish life. Objectives are less well defined for other uses.

Among the more important objectives of a water pollution control program is protection of water quality in streams used as sources of public water supplies. The quality of raw water is an important factor in the design of water treatment facilities and in their operation and maintenance. The factor of safety which can be incorporated in the best water treatment facility is, however, inversely proportional to the specific concentrations of bacteria and toxic elements in water used as source of supply. Therefore, public health and waterworks officials generally measure water quality in terms of its bacteriological, physical, and chemical characteristics. While definite standards of raw water quality have not been adopted, the Manual of Recommended Water Sanitation Practice, Public Health Service Bulletin No. 296, 1946, recommends the following practices: Underground waters not subject to any possible contamination and meeting in all respects the requirements of the Public Health Service Drinking Water Standards as shown by satisfactory, regular and frequent sanitary inspections and laboratory tests, requires no treatment. Underground or surface waters which are subject to a low degree of contamination not averaging more than 50 coliforms (M.P.N.) per 100 ml. of sample in any month and meeting the requirements of the Public Health Service Drinking Water Standards in all other respects should receive a minimum of simple chlorination or its equivalent. Waters which require filtration treatment for turbidity and color removal, waters of high or variable chlorine demand, and waters polluted by sewage to such an extent as to be inadmissible in the prior groups, but containing numbers of coliform bacteria averaging not more than 5,000 coliforms (M.P.N.) per 100 ml. of sample in any one month and exceeding this number in not more than 20 percent of the samples examined in any one month, should be provided complete rapid sand filtration treatment or its equivalent, together with continuous post-chlorination. Waters which meet the requirements of the previous statement with respect to the limiting monthly average coliform numbers but showing numbers of coliforms exceeding 5,000 M.P.N. per 100 ml. in more than 20 percent of the samples examined during any one month and not exceeding 20,000 per 100 ml. in more than 5 percent of the samples examined during any month, should be provided auxiliary treatment in addition to filtration and postchlorination. Auxiliary treatment as used here is presedimentation or prechlorination or their equivalents either separately or combined as may be necessary. Long time storage for periods of 30 days or more represents a permanent and reliable safeguard which in many cases would provide something more than an effective substitute for one or both of the two other methods indicated. Waters which do not meet the requirements cited are considered unsuitable for use as sources of water supply unless they can be brought into conformance with the requirements by means of prolonged preliminary storage or some other measure of equal permanence and reliability, as heavy prechlorination and preliminary coagulation and sedimentation.

In addition to the recommended bacterial requirements, waters for public supply should not contain toxic, taste producing or otherwise harmful substances, or organisms not readily and completely removed by the water treatment processes cited, and should be free of excessive

amounts of acid, microscopic organisms, and organic matters causing any interference with the normal operation and efficiency of the water treatment processes. Whether or not upstream domestic and industrial waste is treated often determines the acceptability of a water as a source of domestic or industrial supply.

Standards adopted by the Public Health Service for Drinking and Culinary Water Supplied by Common Carriers in Inter-State Commerce prescribe limiting maximum concentrations of certain chemical substances inimical to public health, including the following:

Substance	Maximum concentration in parts per million
Lead	0.1
Fluoride	1.5
Arsenic	0.05
Selenium	0.05
Hexavalent chromium	0.05

These standards have received official approval by the American Water Works Association and general acceptance by official health agencies and water works authorities and are widely used as one of the guides for administration of water pollution control programs.

Also of importance are those substances which cause problems of taste and odors. Of particular concern are phenolic and related compounds, minute concentrations of which cause repugnant taste and odor in water supplies. Pollution control programs are aimed at practical elimination of these substances in waters serving as a source of domestic supply.

Quality requirements for industrial water supply vary widely, depending upon the type and nature of industry under consideration. Of general concern are organic and biological constituents, toxic substances, and properties of corrosion, encrustation, and slime formation. Waste control measures materially contribute to improvement of these attributes.

It is generally agreed that a minimum of 5.0 parts per million of dissolved oxygen is necessary, in those streams of the Osage (Marais des Cygnes) - Gasconade Basins affording a suitable fishery habitat, for support of a balanced aquatic life. Because of limited dilution water during critical periods of low flow, secondary treatment, or removal of not less than 75 percent of the Biochemical Oxygen Demand, is required for most sources of pollution in the Basins. Where the quantity of waste is large, as in principal towns where industry is concentrated, a degree of removal substantially in excess of 75 percent may be required to maintain desirable oxygen levels. Removal approaching 90 percent is possible with secondary treatment facilities properly designed and well operated.

Water for recreational usage should be free from floating solids, sludge banks, odors, and discoloration. Contamination of bathing waters by sewage, especially that of recent origin, is objectionable. Quality objectives for the bacteriological content of bathing waters are not firm. However, those recommended as tentative guides for pollution control at

bathing beaches by the Missou i Basin Health Council are as follows:

"For bathing or swimming water, monthly arithmetical average 'most probable number' of coliform organisms should not exceed 1,000 per 100 ml. during any month of the recreational season; nor exceed this number in more than 20 percent of the samples examined during any such month; nor exceed 2,400 per 100 ml. on any day. For nonbathing or nonswimming waters, the monthly arithmetical average 'most probable number' or coliform organisms should not exceed 5,000 per 100 ml. in any month of the recreational season, nor should exceed this number in more than 20 percent of the samples examined during any such month."

Fecal streptococci are receiving increasing attention, as an index of sanitary quality of bathing waters, and sanitary surveys must continue to play the major role in pollution control programs as related to bathing waters.

The protection of water rights must also be considered in determining pollution prevention measures needed. The doctrine of riparian rights, widely applied in States east of the 98th meridian, holds that "all persons owning land abutting on a natural stream have a right to demand that the water shall pass their lands undefiled in quality and undiminished in quantity."[1] The interpretations of the doctrine vary but in general a "reasonable" approach is applied in which stream uses are permitted which do not substantially lessen its quantity or impair its quality. West of the 98th meridian the doctrine of appropriated water rights is usually accepted, although in many areas State water laws incorporate a portion of both doctrines. Where the doctrine of appropriated water rights prevails, consumptive use of water is permitted but no license is thus given to return water to the stream in a defiled condition. The water laws of the State of Kansas contain applicable portions of both doctrines. The riparian doctrine governs in the State of Missouri.

Waste treatment measures are usually tailored to the needs of a community following the engineering evaluation of local sanitary problems. Municipal treatment plants are usually of two general types, one of which removes settleable material from the water under quiescent flow conditions and the other removes polluting material by biological means. Within these categories numerous combinations or adaptions thereof can be used to meet variant conditions of waste from a community and requirements of the receiving stream. Industrial treatment processes vary widely, often within the same general type of industry. Changes in processes, by-products recovery, salvage, improved housekeeping, and comparable practices are often very effective measures of controlling industrial pollution. Control of industrial waste may present an entirely different problem than that incurred in municipal wastes, since the wastes may contain toxic or otherwise objectionable substances not amenable to either sedimentation or biological treatment. However, the objective of the control program remains the same--protection of waters by reduction of objectionable substances to within tolerance levels compatable with water uses. The water pollution control programs in the Osage (Marais des Cygnes) - Gasconade Basins are based on these premises.

[1]Merriman and Wiggins, American Civil Engineers Handbook, page 1750--Legal and Economic Features of Water Rights, 5th Edition.

While sewage and waste treatment processes cannot be controlled precisely, they can be regulated between rather well established limits. The effective removal of solids from domestic wastes by sedimentation is termed primary treatment and is generally considered to reduce 5-day B.O.D.* from 25 to 40 percent. The removal of Biochemical Oxygen Demand by biological methods is termed secondary treatment. A plant incorporating effective primary and secondary treatment is generally considered capable of removing from 75 to 85 percent of the organic polluting material. Greater reduction, sometimes referred to as tertiary treatment, can be obtained by repetitive passages of wastes through the treatment processes or by increasing the number of combinations of treatment processes. Sewage and waste treatment methods thus defined apply only to organic materials that can be decomposed by biological action or those that may be removed by sedimentation. Inorganic waste such as most acids, alkalies, and metallic ions must be controlled by recovery, neutralization, storage, evaporation or other specialized processes. An excellent example of an effective method of controlling inorganic waste is the returning to appropriate underground formations the waters of high chloride content which were originally pumped with the oil to the earth's surface. The control of oil field brines in this matter is extensively practiced in the State of Kansas. In general, the water pollution control agencies of Kansas and Missouri recognize the following concepts:

(1) Toxic substances including metallic ions, phenol compounds, oils, and acids must be virtually excluded from streams. Such substances are inimical to aquatic life and if present in sufficient concentrations are hazardous to human life and to livestock.

(2) Removable of settleable and floating solids to prevent sludge banks, floating materials, and nuisance conditions should be required as the minimum acceptable treatment. Property values, recreation, fishing, stock watering, and other water uses are thus provided a measure of protection.

(3) The degree required beyond effective primary treatment is influenced by downstream water uses and by the amount of dilution water available during periods of low flow. Biological removal of dissolved organic materials and bacteria must be provided where necessary to: (a) maintain dissolved oxygen at levels necessary for balanced aquatic life; (b) maintain desirable water quality for domestic, industrial, or recreational uses; and (c) prevent nuisance or other health hazards.

(4) For industrial wastes similar in nature to municipal wastes, treatment should be based on the same premises as that recommended for municipalities. For industrial wastes not similar to municipal wastes, treatment should be provided as necessary to prevent substantial deterioration of water quality in the receiving stream.

*Biochemical Oxygen Demand is the quantity of oxygen utilized by microorganisms under aerobic conditions while feeding on and stabilizing organic materials. The test for 5-day B.O.D. is described in Standard Methods of Water and Sewage Analysis.

Future water pollution control programs in the Osage (Marais des Cygnes) - Gasconade Basins will be largely a matter of extending present work with emphasis on:

(1) The enactment of comprehensive pollution control legislation in Missouri;

(2) The provision of plants where none now exist, and the improvement of existing plants now inadequate;

(3) Dissemination of information concerning the effects of pollution on public health, fishing, and other water uses;

(4) Better operation of existing sewage works;

(5) Improved maintenance of existing sewage treatment plants;

(6) Surveillance of stream conditions to supplement sewage treatment plant inspections so that the need for improved treatment can be foreseen well in advance of actual necessity, thus enabling planning and construction to be carried forward with a minimum of delay;

(7) Minimizing the adverse effects of mine drainage by effecting a program of improved strip mine operations.

Recent legislation in the State of Missouri covering the financing of municipal sewage systems greatly increases the flexibility of municipal financing in that State. It provides that revenue bonds can be issued for the purpose of constructing, operating, and maintaining municipal sewage treatment works. Municipal sewage works financing laws of the State of Kansas have been somewhat more liberal than those in Missouri prior to 1951. However, the advantages of financing treatment works through the use of sewer service charges is not available to first and second class cities in Kansas. Some of the difficulties experienced in obtaining sewage treatment would be alleviated by allowing all Kansas cities to use revenue financing for construction, operation, and maintenance of municipal sewage treatment works.

The cost of adequate sewage treatment facilities, including original construction cost, operation, and maintenance has been estimated to be between $9 and $15 per year per family, depending upon the size of the community and the degree of treatment required. Family costs are usually lower as the size of the community increases. The cost of constructing adequate treatment facilities for all known organic wastes originating in the Osage (Marais des Cygnes) - Gasconade Basins is conservatively estimated at $1,000,000.

Water pollution control legislation in the State of Kansas has been in effect many years and has been found to be adequate in most respects. A detailed discussion of the Kansas legislation is found in appendix B of this report. Stream pollution control legislation in Missouri is very limited in scope, pertaining only to pollution as related to public health, public water supplies, and nuisances. A great deal of stream pollution control has been established by the

responsible agencies in the State of Missouri without benefit of a comprehensive stream pollution law. Comprehensive legislation would do much, however, to bring together common interests in stream pollution control, would generally expedite stream pollution control actions, and would establish a single agency which would be charged with responsibility of enforcing such rules and regulations as might be established by or required for a comprehensive stream pollution control program. The psychological value of such legislation is of considerable importance, and would greatly aid any informational program embarked upon by the responsible State agency.

A number of flood control dams and reservoirs have been proposed for the Osage (Marais des Cygnes) - Gasconade River systems (a list of these proposed sites is included in appendix A, table 15, of the report). Controlled release of water from these reservoirs could augment the present minimum stream flows of record (under natural conditions), and thus be of considerable value to stream sanitation by increasing the amount of water available for diluting sewage treatment plant effluents. This value is recognized by the State water pollution control agencies, and inclusion of storage in the reservoirs to augment low flows would be of benefit to the citizens of the Basins.

Surveys of most of the sources of pollution in the Osage (Marais des Cygnes) - Gasconade Basins have been made by the State water pollution control agencies and reports, containing findings of the investigations together with recommendations for correcting or improving conditions, have been provided municipal and industrial officials and other interested parties. State reports are available for public inspection. The State water pollution control agencies have further cooperated with representatives of numerous industries and municipalities through conferences regarding specific problems of pollution, and have worked closely with the engineers officially employed by municipalities and industries to study pollution problems. These activities were inaugurated several years ago as a part of a continuing program. Numerous engineering studies have been made and, while some were made sometime ago, they generally substantiate treatment needs as indicated in this report.

A synopsis of the needs of municipalities, institutions, and industries necessary to prevent pollution of the streams in the Osage (Marais des Cygnes) - Gasconade River Basins is presented here and in tables 9, 10 and 11.

Quenemo, Kansas

The municipal sewer system of Quenemo serves about 400 people. Sewage is treated in a plant capable of satisfactory treatment, but the plant is poorly located and subject to frequent flooding. The effluent is discharged to the Marais des Cygnes River. The Kansas State Board of Health considers the plant adequate but that its operation is difficult and is in need of improvement. The maintenance of a high degree of treatment at the Quenemo sewage treatment works is necessary to protect the water supply at Ottawa, Kansas, a relatively short distance downstream from Quenemo.

Lyndon, Kansas

A municipal sewage plant consisting of septic tanks and contact beds built in 1912 provides an unsatisfactory degree of treatment for the sewage from about 700 residents of Lyndon. The effluent is discharged into Salt Creek and thence to the Marais des Cygnes River a short distance below Quenemo. The Kansas State Board of Health has recommended that the obsolete plant at Lyndon be replaced by a modern treatment works. This source of pollution is also above Ottawa, and secondary treatment is necessary for the continued protection of the Ottawa water supply.

LaCygne, Kansas

The municipal sewer system serves approximately 800 people. The existing plant provides primary treatment only, and the effluent is discharged into the Marais des Cygnes River. The LaCygne plant is the only primary treatment plant remaining in the Kansas section of the Osage (Marais des Cygnes) Basin. The Kansas Board of Health has recommended that secondary treatment units be added to the existing facility.

Pleasanton, Kansas

A secondary treatment plant serves this municipality of 1,000 inhabitants. The plant, an Imhoff tank and fixed nozzle filter built in 1926, is in many ways obsolete. In the opinion of the Kansas State Board of Health, the plant is no longer capable of producing a satisfactory effluent. The State agency has recommended that the existing plant be replaced by one of adequate capacity. Effluent from the sewage plant is discharged into a small stream, therefore it is necessary that a high degree of treatment be provided in order to avoid local nuisance conditions and devaluation of the stream for livestock watering.

Fort Scott, Kansas

The municipal sewage collection system serves approximately 10,000 residents and several small industries. A septic tank was constructed many years ago to remove the settleable materials from the Fort Scott sewage prior to its discharge into the Marmaton River. The plant was overloaded shortly after its construction and little or no treatment resulted. Nuisance conditions in the Marmaton River below Fort Scott and continuing from Kansas into Missouri resulted in a Kansas Board of Health directive to the City of Fort Scott to construct adequate sewage treatment works. A new plant incorporating partial secondary treatment is now in operation. While additional filter rock and final settling are yet to be provided, the present works satisfactorily removes the last interstate pollution of organic nature in the Osage (Marais des Cygnes) Basin.

Nevada, Missouri

Plans have been approved by the Missouri Division of Health for construction of two municipal sewage treatment plants at Nevada. The south plant will handle the wastes from the city and the north plant will treat sewage from both the city and the nearby State Hospital

No. 3. At the present time sewage from Nevada and the hospital is discharged without treatment into the Marmaton River. The municipal sewage also contains industrial wastes, including that from a creamery. Construction of this project has been delayed pending financial arrangements, including an appropriation by the State for its share of the project. The plants are needed and construction should proceed immediately.

Eldorado Springs, Missouri

This municipality of 2,600 people has constructed part of the primary treatment portion of a sewage works; the Missouri Division of Health recommends that the rest of the plant, including secondary treatment, also be constructed. In addition to sewage from the domestic population, considerable quantities of dairy plant wastes are also collected. The effluent is discharged to Walnut Creek, thence into Clear Creek and into the Osage River. A high degree of treatment is necessary at Eldorado Springs in order to avoid local nuisance conditions below the city and to protect the fish life, stock watering, and other uses in these streams.

Greenfield, Missouri

Sewage from the 600 inhabitants is treated in two primary treatment works and the effluents discharged to Sons Creek, a tributary of the Sac River. In addition to sewage from residents of Greenfield, a cheese plant also contributes waste to the municipal sewer system. The Missouri Division of Health has recommended that secondary treatment be provided at each plant to prevent nuisances downstream from the city, to preserve fish life, and to prevent deterioration of the water quality for livestock watering and other uses.

Stockton, Missouri

A part of this municipality of 800 inhabitants is sewered and a septic tank removes part of the settleable material from the sewage prior to its discharge into the Stockton Branch of the Sac River. The present treatment works is obsolete and grossly overloaded. The Missouri Division of Health recommends that an entirely new plant employing secondary treatment be built at Stockton

Osceola, Missouri

The municipal sewer system serves about 500 people. A septic tank has been provided to remove the settleable materials from the sewage prior to discharge into the Osage River. In addition to household sewage a considerable quantity of waste from a cheese factory is also discharged into the sewage system. Treatment provided by the septic tank is grossly inadequate. The Missouri Division of Health has recommended that the sewage system be extended and a new treatment plant employing secondary treatment be constructed.

Bolivar, Missouri

This city of 3,500 inhabitants is served by a municipal sewage system and the sewage is treated. In addition to household sewage a

considerable amount of waste is contributed from dairies and a milk processing plant. These industrial wastes are approximately equal to the domestic wastes of the city. In order to protect from gross pollution the small stream which receives effluent from this sewage treatment plant, the Missouri Division of Health has recommended that the treatment works in Bolivar be enlarged. Plans for the enlargement have been made by the city officials and approved by the Missouri Division of Health. Construction of the project is recommended by the Division of Health.

Belton, Missouri

This municipality of 1,200 population has a sewer system and treatment plant. When originally built the treatment works was capable of providing a high degree of treatment, however growth of the municipality over a period of years has considerably overloaded the plant, thus greatly reducing its efficiency. In view of the proximity of Belton to the metropolitan area of Kansas City there is considerable likelihood that the municipality will continue to grow. Also, the expansion of defense activities in the southern Kansas City area will continue to reflect in an increased sewage load at this community. In order to protect the usefulness of the stream into which the treated wastes are presently discharged the Missouri Division of Health has recommended that the present treatment works be sufficiently enlarged to provide adequate secondary treatment.

Harrisonville, Missouri

About two-thirds of Harrisonville's population of 2,500 are served by the municipal sewer system. The settleable material in the sewage is removed prior to discharge into the east branch of the South Grand River. The present treatment plant is considered inadequate and the Missouri Division of Health has recommended that an entirely new sewage treatment works be constructed. The city officials of Harrisonville have authorized a sewer service charge for the purpose of accumulating a fund for construction of a new treatment works. The present rate of accumulations is such that the fund will not be sufficiently large to cover the cost of construction within a reasonable time. The early construction of an adequate treatment works at Harrisonville is urged.

Pleasant Hill, Missouri

More than 1,500 of this municipality's 2,200 inhabitants are provided service by the municipal sewer system. The septic tank treatment now provided is totally inadequate. Conditions in the creek below Pleasant Hill are unsatisfactory, therefore the Missouri Division of Health has recommended that an entirely new plant be constructed at Pleasant Hill. While this need has been acknowledged by city officials, progress has of necessity been delayed because of a vital water works improvement program.

Clinton, Missouri

More than 60 percent of this city of 6,000 inhabitants are provided sewer service. Sewage from the central and western portion of the city receives primary treatment only. Sewage from the eastern

portion of the town, while once pumped to the treatment plant, is now discharged untreated into Coal Creek. Preliminary engineering studies indicate a need of improving the existing plant to provide secondary treatment and a second and comparable plant to serve the remainder of the town. The Missouri Division of Health has recommended that the city provide secondary treatment. While two plants appear to be required, further and more detailed studies have been suggested by the Division of Health, with the thought that one plant may suffice.

Warsaw, Missouri

In this municipality of 1,000 people about two-thirds are provided sewage collection service. When the system was built septic tank treatment was provided. The growth of the municipality and the ensuing increase in wastes has greatly overloaded the tank, the effluent of which is discharged into the Lake of the Ozarks. Due to the need for protecting the Lake against inroads of pollution the Missouri Division of Health recommends that an entirely new sewage treatment plant, including secondary treatment and chlorination, be constructed.

Camdenton, Missouri

The municipality of Camdenton is a very rapidly growing center of the Ozarks resort industry. The original sewer system, including the two septic tanks, was intended to serve only the business area. The septic tanks are now practically useless. The south plant discharges indirectly to the Niangua River and the north plant discharges indirectly into Lynn Creek. Both streams are arms of the Lake of the Ozarks. Plans for extension of this system and for the construction of one sewage treatment works employing secondary treatment instead of the present two plants, have been approved by the Missouri Division of Health, and construction of the system and treatment work is considered urgent.

Newburg, Missouri

Construction of a sewer system and a mechanical activated sludge plant was initiated by the city in 1943, in cooperation with the Federal Works Agency. Because of adverse construction conditions, a torrential rain, and other difficulties, the project was never satisfactorily completed. Connections to the sewer system, if any, are both limited in number and unauthorized by the city. Reactivation of this project and its completion is recommended by the Division of Health. Necessary for this action would be the disposition of the Federal interest in the uncompleted and inactive project.

* * * *

In addition to the municipal plants described in the previous section, numerous industrial installations have need for improved waste treatment. The following is a brief description of these needs:

Cheese Plant, Hartville, Missouri

The company operating the cheese manufacturing plant at Hartville has installed a treatment works. The treatment plant, however, is

insufficient in size to adequately treat the volume of waste, therefore the Missouri Division of Health has recommended that the existing plant be enlarged. The effluent from the treatment plant is discharged into Woods Fork of the Gasconade River. Construction of the recommended improvements is urged.

Cheese Plant, Rockville, Missouri

The waste from a small cheese plant located near the municipality of Rockville discharges wastes into a small creek. The volume of waste, although comparatively small, is sufficient in times of low flow to cause unsatisfactory conditions, therefore treatment or other means of controlling the pollution effects of the waste should be instituted.

Cheese Plant, Stockton, Missouri

The cheese manufacturing plant discharges its wastes into the Stockton branch of the Sac River. These wastes, in conjunction with the wastes from the municipality, produce a considerable degree of pollution in the stream. Treatment or other means of controlling the waste from the cheese plant should be instituted.

Cheese Plant, Osceola, Missouri

The wastes from the cheese manufacturing plant are discharged without treatment into the Osage (Marais des Cygnes) River. Treatment removing at least 75 percent of the polluting material should be provided.

Cheese Plant, Buffalo, Missouri

The cheese manufacturing plant discharges partially treated waste to a small creek tributary to the Niangua River. The wastes are conveyed to a septic tank and thence through a tile drain to the creek. Since very little of the pollutional material is removed by the existing septic tank treatment, more effective means of controlling the pollution are needed. The construction of a municipal sewerage system at Buffalo would aid both the industry and the municipality.

Meat Packing Plant, Clinton, Missouri

This small slaughtering plant normally kills from 8 to 10 [illegible]eves and 12 to 16 hogs per week. Wastes from the slaughtering operations and from the stock pens are discharged into the South Grand River without treatment. Although the volume of waste is small, it is quite strong and adds considerably to pollution in the stream. It is therefore recommended that a means of controlling the waste at its source be provided by the packing company.

Meat Packing Plant, Lebanon, Missouri

The packing plant discharges its waste through a settling pond into a branch of the Grand Glaize River. About 25 cattle and 35 hogs are slaughtered each week at this plant. Conditions in the receiving stream below the outlet are noted to be unsatisfactory. A better method of controlling the wastes is needed.

Canning Plant, Polk, Missouri

The canning plant specializes in canning tomatoes and tomato products. Over 200 cases of tomatoes are canned per day during the height of the season. The tomato washings are discharged into Panther Creek, a tributary of Pomme de Terre River. Treatment, or other means of controlling the pollutional effect of these wastes, is needed.

Cheese Plant, Humansville, Missouri

Wastes from the cheese manufacturing plant are discharged into a small creek, a tributary of the Sac River. The waste is passed through a settling tank and a skimming basin prior to being discharged. Pollution in the receiving stream is sufficient to produce a very noticeable effect, indicating that a higher degree of treatment is needed. The municipality of Humansville does not have a municipal sewerage system at the present time, however plans for a system have been approved by the Missouri Division of Health. These plans do not include treatment for milk wastes. Better control of the milk waste is urgently needed. The construction of the municipal system, with provision for including industrial wastes, would constitute the most satisfactory solution of this problem.

Table 9. Osage (Marais des Cygnes) - Gasconade River Basins - Needs for municipal and industrial waste treatment plants

	Municipal		Industrial
Needs	Number	Population served by facilities	Number
New plant	8**	22,050	8*
Enlargement or additions to existing plant	9	19,007	1
Replace existing plant	2	1,600	-
No project required	26	33,670	-
Undetermined	0	-	-

*Includes 1 where plant has been previously installed but which must be completely new, therefore the State considers it to be a "new plant needed" rather than a "replacement."

**Includes 6 municipalities having septic tanks, one of which has two plants, where entirely new plants have been recommended by State water pollution control agencies. Two sources, Nevada, Mo. and State Hospital No. 3, plan to construct two plants for joint usage.

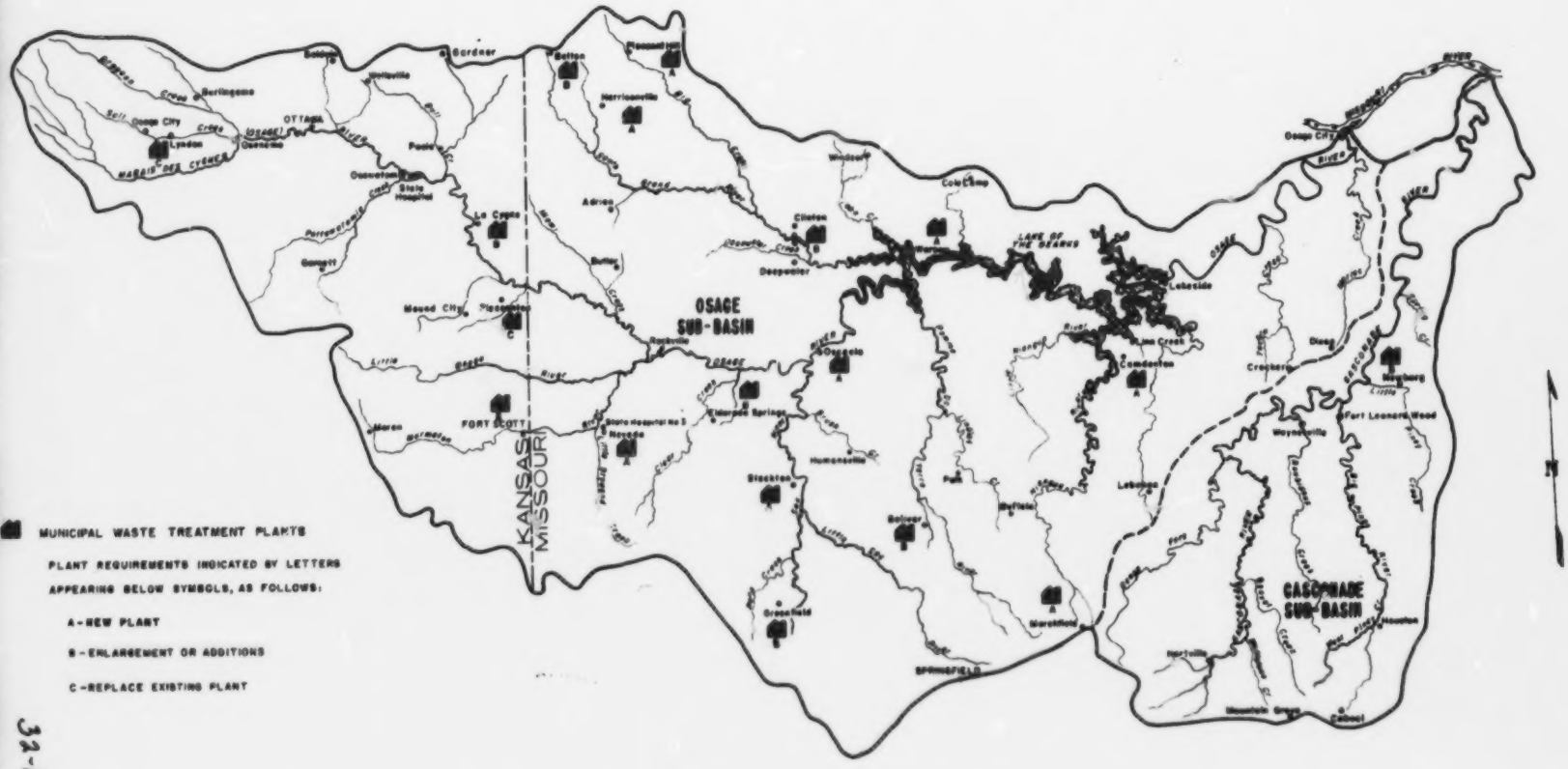
Table 10. Osage (Marais des Cygnes) - Gasconade River Basins - Current status of municipal and industrial action on pollution abatement needs

Status of project	Number of municipalities	Number of industries
No action	11	1
Abatement ordered	0	0
Final plans approved	5	1
Construction awaiting financing	0	0
Under construction	1	0
Status undetermined	0	0
Planning initiated	1	7

Table 11. Osage (Marais des Cygnes) - Gasconade River Basins - Progress in pollution abatement

	Municipal		Industrial
Year	Plants completed	Design population	Plants completed
1946	0	-	0
1947	1	750	0
1948	1	1,500	0
1949	0	-	0
1950	3*	13,200	0

*Includes two remodeled plants.



MUNICIPAL WASTE TREATMENT PLANTS

PLANT REQUIREMENTS INDICATED BY LETTERS APPEARING BELOW SYMBOLS, AS FOLLOWS:

A - NEW PLANT

B - ENLARGEMENT OR ADDITIONS

C - REPLACE EXISTING PLANT

32-B

OSAGE - GASCONADE RIVER BASIN LOCATION MAP

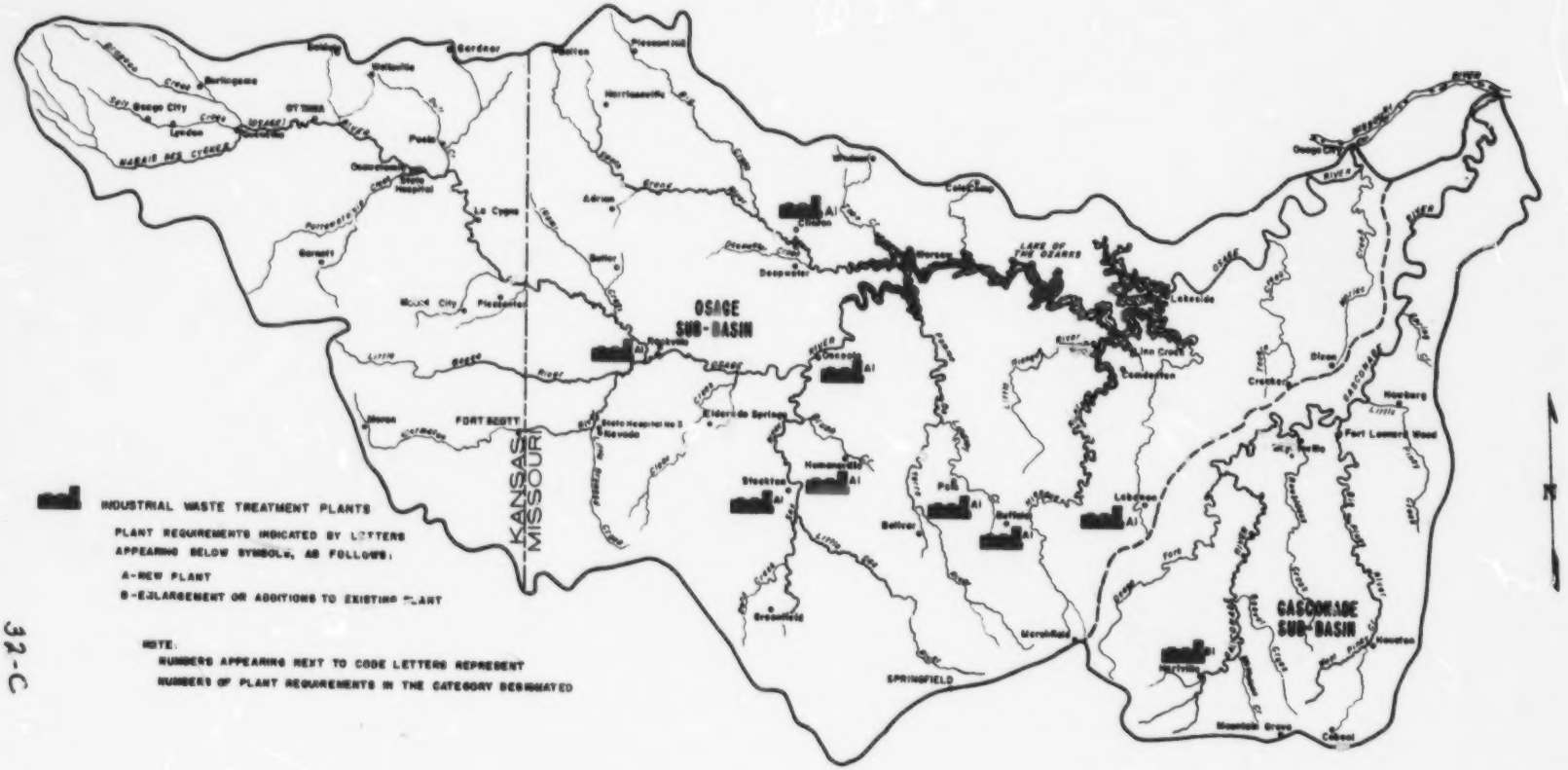
Scale

10 5 0 10 20 30 40 miles

OSAGE - GASCONADE RIVER BASIN

MUNICIPAL WASTE TREATMENT NEEDS

MAP NO. 5



32-C

OSAGE - GASCONADE RIVER BASIN LOCATION MAP

Scale

10 5 0 10 20 30 40 miles

OSAGE - GASCONADE RIVER BASIN

INDUSTRIAL POLLUTION ABATEMENT NEEDS

MAP NO. 6

APPENDIX A

Table 12. Osage (Marais des Cygnes) - Gasconade River Basins - Lengths of streams and size drainage areas

OSAGE (MARAIS DES CYGNES) RIVER AND MAJOR TRIBUTARIES		
Stream	Length (Miles)	Drainage Area (sq. mi.)
Osage River	-	15,300
Little Osage River	68	1,720
Sac River	107	1,970
Pomme de Terre River	113	828
South Grand River	125	2,040
Niangua River	130	1,040

GASCONADE RIVER AND MAJOR TRIBUTARIES		
Stream	Length	Drainage Area
Gasconade River	270	3,600
Osage Fork	72	520
Roubidoux Creek	56	300
Big Piney Creek	84	760
Little Piney Creek	33	278

Table 13. Osage (Marais des Cygnes) River Basin - Probable frequency of low mean monthly discharges

Years[1] of record	Stream and location	Miles to mouth Osage River	Miles to mouth Tributary	Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	5 years	5 years	10 years	Minimum low mean monthly flow of record
	SUMMER PERIOD (JUNE-SEPT)								
	Osage River (Marais des Cygnes)								
13	Quenemo, Kansas.	428		1,030	3	0.9	0.3	0	0
	Salt Creek	425							
7	Lyndon, Kans.		10	111	2	1	0.6	0.4	0
	Osage River (Marais des Cygnes)								
22	Ottawa, Kans.	396		1,250	9.5	3.0	1.2	0.4	0
	Pottawatomie Creek								
7	Garnett, Kans.		37	334	8.5	3.5	1.5	0.7	1.1
	Osage River (Marais des Cygnes)								
18	Trading Post, Kans.	316		2,880	31	8.5	2.5	0.6	0
	Marmaton River		18						
17	Fort Scott, Kans.		28	411	2.5	1.5	0.8	0.45	0.4
	Sac River	235							
22	Stockton, Mo.		40	1,160	132	67	59	39	8.22
	Osage River								
20	Osceola, Mo.	230		8,220	355	186	100	52	7.5
	Pomme de Terre River								
22	Hermitage, Mo.		29	655	89	17.5	11	7	0.12
	South Grand River	176							
22	Brownington, Mo.		32	1,660	13	4.5	1.5	0.5	0
	Niangua River	113							
15	Decaturville, Mo.		14	627	187	166	148	130	107
	Osage River								
21	Bagnell, Mo.		80	14,000	1,380	1,050	795	600	492
15	St. Thomas, Mo.		46	14,750	1,660	1,410	1,150	910	631
	WINTER PERIOD (DEC-FEB)								
	Osage River (Marais des Cygnes)								
13	Quenemo, Kans.	428		1,030	9	3.5	1.5	0.6	1.8
	Salt Creek	425							
7	Lyndon, Kans.		10	111	4	2	1	0.6	0
	Osage River (Marais des Cygnes)								
22	Ottawa, Kans.	396		1,260	19	6	2	0.7	0.07
	Pottawatomie Creek	367							
7	Garnett, Kans.		37	334	26	7.5	2	0.6	0
	Osage River (Marais des Cygnes)								
18	Trading Post, Kans.	316		2,910	105	25	6.5	1.6	0
	[illegible]ton River		18						
17	Fort Scott, Kans.		28	411	30	15	7.5	3.8	1.0
	Sac River	235							
22	Stockton, Mo.		40	1,160	302	199	138	87	55.2
	Osage River								
20	Osceola, Mo.	230		8,220	1,150	550	270	125	78.8
	Pomme de Terre River	187							
22	Hermitage, Mo.		29	655	148	89	56	35	20.8
	South Grand River	176							
22	Brownington, Mo.		32	1,660	75	24	8.0	2.5	0.32
	Niangua River	113							
15	Decaturville, Mo.		14	627	242	211	186	162	145
	Osage River								
21	Bagnell, Mo.	80		14,000	3,230	2,180	1,580	1,120	586
15	St. Thomas, Mo.	46		14,500	3,160	2,240	1,580	1,100	640

Table 14. Gasconade River Basin - Probable frequency of low mean monthly discharges

Years[1] of record	Stream and location	Miles to mouth Gasconade River	Miles to mouth Tributary	Drainage area square miles	Minimum monthly mean flows in cubic feet per second that may be expected once in: 2 years	5 years	5 years	10 years	Minimum low mean monthly flow of record
	SUMMER PERIOD (JUNE-SEPT)								
	Gasconade River								
13	Hazelgreen, Mo.	180		1,250	116	110	66	40	31
16	Waynesville, Mo.	136		1,680	184	153	133	87	62
	Big Piney River	115							
16	Big Piney, Mo.		22	560	132	121	103	98	89
	Little Piney River	108							
13	Newburg, Mo.		4	200	43	37	36	28	28
	Gasconade River								
16	Jerome, Mo.	107		2,840	599	513	486	353	324
16	Rich Fountain, Mo.	53		3,180	622	558	548	401	334
	WINTER PERIOD (DEC-FEB)								
	Gasconade River								
13	Hazelgreen, Mo.	180		1,250	247	194	162	144	123
16	Waynesville, Mo.	136		1,680	509	296	255	206	185
	Big Piney River	115							
16	Big Piney, Mo.		22	560	234	191	156	135	127
	Little Piney River	108							
13	Newburg, Mo.		4	200	64	56	45	39	36
	Gasconade River								
16	Jerome, Mo.	107		2,840	1,090	762	630	584	554
16	Rich Fountain, Mo.	53		3,180	1,232	814	722	640	581

[1]Basic data obtained from publications of the U. S. Geological Survey.

Table 15. Osage (Marais des Cygnes) - Gasconade River Basins - Proposed reservoir construction program***

Reservoir	Location and stream	Drainage area (square miles)	Capacity (acre-feet) Flood control	Conservation and sediment**	Total
Osage River Basin					
Pomona	Hundred Ten Mile Creek	322	155,000	26,000	181,000
Melvern	Marais des Cygnes River (mile 442.1)	352	170,000	28,000	198,000
Garnett	Pottawatomie Creek	334	160,000	26,000	186,000
Hillsdale	Big Bull Creek	144	77,000	13,000	90,000
Fort Scott	Marmaton River	306	130,750	6,250	137,000
Hackleman Corner	Cedar Creek	415	212,300	7,700	220,000
Stockton	Sac River	1,160	774,000	226,000	1,000,000
Pomme de Terre	Pomme de Terre River	611	378,000	197,000	575,000
Kasinger Bluff	Osage River (mile 175.0)	7,846*	3,918,000	122,000	4,040,000
Gasconade River Basin					
Richland	Gasconade	1,386	813,100	586,900	1,400,000
Rich Fountain	Gasconade	3,223	1,077,700	332,200	1,409,900

*Area below upstream reservoirs.
**Capacity available for water supply and sanitation.
***Taken from Army Engineer Corps Report - House Document No. 549, 81st Congress, 2nd Session.

APPENDIX B

Kansas Water Pollution Control Legislation

1. General Statement

The laws of Kansas relating to water pollution control could not be termed comprehensive. For the purpose of preventing stream pollution detrimental to public health or to animal and aquatic life, the State Board of Health with the approval of the State forestry, fish, and game commission is given the duty of making rules and regulations governing the disposal of domestic and industrial sewage wastes by municipalities, corporations, companies, or individuals. G.S. 1947 Supp. 65-171d. The State Board is given general supervision of the health of the citizens of Kansas, including the effect of the water supply upon the health of the people. Gen. St. 1935, 65-101.

The governing body of any city of the first class having a population of 95,000 or more is empowered to provide for one or more systems of disposal works for the purification of the sewage of the city, and to build, operate, and maintain such disposal works, the cost of building to be borne by the city as a whole. Gen. St. 1935, 13-1018f. Such sewage-disposal works may be constructed within the city limits or within five miles of such limits. Gen. St. 1935, 13-1018g. Similar authority is specifically conferred upon the governing body of any city having a population of more than 60,000 and less than 110,000. Sec. 1, ch. 133, Laws of Kansas, 1949.

The Kansas State Board of Health has been designated by the Surgeon General as the State water pollution agency in accordance with the terms of Public Law 845-80th Congress.

The following Kansas Water Pollution Statutes direct water pollution activities: sections 65-161 and 65-164 thru 65-171e of the 1935 General Statutes cover primarily sewerage and stream pollution; 55-115, 55-117 thru 55-122, 55-128, 55-132 thru 55-135, and 55-902 of the 1935 General Statutes, 55-136 thru 55-138, 55-901, 55-1003 and 65-171d of the 1947 General Statutes Supplement, and 65-171e, 65-171f, 55-606 and Senate Bill 168 of the 1949 General Statutes Supplement, along with the State Corporation Commission Rules and Regulations 82-2-118 thru 82-2-124, 82-2-300 thru 82-2-306, 82-2-400 thru 82-2-405, and 82-2-500 thru 82-2-505, apply primarily to oil field pollution control.

II. Administrative Organization

The Kansas State Board of Health, composed of 5 physicians (M.D.'s) 1 hospital administrator, 1 sanitary engineer, 1 druggist, 1 veterinarian, and 1 dentist, is appointed by the Governor and confirmed by the Senate to serve for a term of three years, three of whom are appointed annually. A chairman is selected by the remainder of the Board. The secretary, who is the executive officer of the Board, is also elected.

III. Powers and Duties

1. Development of Comprehensive Programs. No specific statutory authorization for a comprehensive program is written into law, however, usage indicates that a comprehensive program is possible.

2. Issuance of Permits and Review of Plans and Specifications. Every municipal corporation, private corporation, company, and individual supplying water to the public must file with the State Board of Health a certified copy of the plans and surveys of the waterworks with a description of the source from which the water supply is derived. No additional source of supply may be used without a written permit from the State Board. Gen. St. 1935, 65-162.

No one shall supply water for domestic purposes to the public by means of any waterworks without a written permit from the State Board of Health. The application for such permit must be accompanied by a certified copy of the maps, plans, and specifications for the construction of such waterworks or extension, and a description of the source from which it is proposed to derive the supply of water and the manner of storage, purification, or treatment therefor, together with any other data and information required by the State Board. It is further provided that no other or additional source of water supply shall subsequently be used, nor any changes made in the manner of storage, purification, or treatment without an additional permit. G.S. 1947 Supp., 65-163. The State Board may order the cessation of the delivery of any waters through pipes and mains to any premises whereon any condition exists that might lead to the contamination of the public water supply and when such an order is made the delivery of water shall immediately cease until the danger of contamination is eliminated. G.S. 1947 Supp., 65-163a.

Upon application to the State Board a sewerage company or a public authority may obtain a permit to discharge sewage prohibited by law into any of the waters of the State whenever it is the unanimous opinion of the governor, the attorney general, and the secretary of the Board that the general interests of the public health would be served thereby. Every such permit is revocable or subject to modification by the State Board after due notice, investigation, and hearing. The conditions on which such discharge will be permitted may be stipulated in the permit, and the length of time within which the discharge shall be discontinued may also be stated therein--which in no case shall be less than one year, nor more than two years. New permits may be granted in the same manner as originally. G.S. 1947 Supp., 65-165.

3. Enforcement. Compliance with orders of the State Board of Health requiring the cessation of the pollution of waters within a reasonable time, or the manner of treatment or the disposition of sewage or other polluting material necessary to prevent future water pollution is mandatory. Within 30 days of the date of such an order an appeal may be taken to the district court of the county in which the pollution or polluted condition occurs, and the court may set aside or modify the order or fix the terms upon which a permit shall be granted. Gen. St. 1935, 65-164.

Failure to comply with the rules, regulations, and orders of the State Board of Health relative to stream pollution is a misdemeanor and punishable, upon conviction, by a fine or not less than $25. nor more than $200. for each offense. Each day's failure to so comply constitutes a separate offense. Sec. 2, ch. 327, Laws of Kansas, 1949.

The penalty for the discharge of sewage from any public sewer system into any waters of the State without a duly issued permit, where a permit is required, is $500. and an additional penalty of $50. is provided for each day the offense is continued. Gen. St. 1935, 65-167. The term "waters of the state" is defined as including all streams and springs and all bodies of surface and of impounded ground water, whether natural or artificial, within the boundaries of the State. Gen. St. 1935, 65-161.

Anyone who fails to furnish, on demand, to the State Board such information as may be required shall be deemed guilty of a misdemeanor and, upon conviction, may be fined not less than $50. nor more than $500. Failure to fully comply with the requirements of the State Board is a misdemeanor and, upon conviction, a fine of not less than $25. nor more than $100. may be assessed. Each day of failure to comply constitutes a separate offense. Gen. St. 1935, 65-169. Suits under the provisions of the water pollution control statutes are brought in the name of the State of Kansas by the attorney general, and fines and penalties recovered are placed in the State school fund. Gen. St. 1935, 65-170.

Upon presentation of evidence by the State Board the attorney general may take such action as necessary to secure the abatement of pollution of surface waters detrimental to animal and aquatic life. Gen. St. 1935, 65-171b.

The supplying of water for domestic purposes by means of any waterworks without a permit from the State Board is a misdemeanor and, upon conviction, punishable by a fine of not less than $25. nor more than $50. for each offense, each day's violation being considered a separate offense. G.S. 1947 Supp., 65-163.

Whenever the State Board finds that the storage of salt waters or mineral brines in any pond is likely to cause pollution, it may enter an order prohibiting such storage in such pond, the order to take effect within 10 days after notice in writing to the owner or person having charge of the pond. A hearing before the State Board and court appeal from any order thereafter entered is provided. G.S. 1947 Supp., 65-171d.

4. Conduct of Studies, Investigations, and Research. 1/ Required analyses of all waters are made at the water and sewage laboratory of the State Board in the University of Kansas and fees collected therefor are held by the State treasury for the benefit of the laboratory. Gen. St. 1935, 65-157.

1/ A resolution was adopted by the Kansas State Board of Health in 1946 which instructed the Division of Sanitation to enter into a cooperative agreement with the League of Kansas Municipalities for the purpose of making a study and reporting on legislation needed in connection with financing the construction, enlargement and maintenance, and operation of public sanitary sewer systems and sewage treatment plants.

The engineer of the State Board of Health is selected by the Board from the members of the faculty of the school of engineering of the State university or agricultural college, and it is his duty to investigate and report upon all matters relating to water supply, sewerage, and the pollution of the waters of the State, that may be the subject of investigation or action by the Board. The engineer has the duty of making such special investigations in relation to methods of sewage disposal and public water supply and the purification of waters as may be necessary in order to make proper recommendation, or as may be required by the State Board. Gen. St. 1935, 65-170.

All investigations, services, and orders rendered, issued, or promulgated relating to the prevention of stream pollution are made by such agency, section, or division of the State Board of Health as may be designated in writing by the State Board. Sec. 1, ch. 327, Laws of Kansas, 1949.

It is the duty of the State Board to investigate the character of public water supply, and information with respect to the source thereof shall be furnished at the request of the State Board. G.S. 1947 Supp., 65-163.

A general statute provides that each State agency is required to make a biennial report to the governor at least 10 days preceding each regular session of the legislatur , which report covers the two fiscal-year periods immediately preceding such session. The report includes a brief condensed outline of the agency's activities and proceedings, a financial statement, and an enumeration of statutory provisions which should be amended or repealed, together with recommendation of any needed new legislation. G.S. 1947 Supp., 75-3046.

5. Cooperation with Other Public and Private Agencies. The State forestry, fish, and game commission is designated in Gen. St. 1935, 74-3308, as the State agency to make application and procure aid from the Federal Government in all matters pertaining to the control and utilization of waters. A later provision enacted in 1943, however, authorizes the State Board of Health to receive grants of money and funds appropriated under any Federal act. G.S. 1947 Supp., 65-103a.

6. Administrative Powers. The Board of Health is given the power and duty to make investigations of the causes of disease and the effects of water supply upon the health of the people. The Board is empowered to make and enforce regulations to obstruct and prevent the introduction or spread of infectious or contagious diseases. Gen. St. 1935, 65-101.

It is the duty of the State Board of Health to make, adopt, and publish such rules and order of business as may be necessary and to facilitate the transaction of its business. Gen. St. 1935, 74-902.

The State Board is authorized and it is its duty to make rules and regulations for the collection of samples and the analysis of water, natural or treated, supplied the public. Gen. St. 1935, 65-156. If, upon investigation, the State Board shall find that

any of the waters of the State have been or are being polluted in a manner prejudicial to the health of the inhabitants, it has the authority to make an order requiring such pollution to cease within reasonable time, or to require such manner of treatment or disposition of sewage or other polluting material necessary to prevent future water pollution. Gen. St. 1935, 65-164.

The secretary or the engineer, or both, of the State Board of Health, may act for the Board when it is not in session, and their decisions have the same force and effect as though made by the Board when confirmed by the governor and attorney general. Gen. St. 1935, 65-170.

The authority of the State Board of Health in matters of stream pollution is by statute specifically supplemented to include such pollution found to be detrimental to the public health or to animal or aquatic life. Gen. St. 1935, 65-171a.

The Board of Health has the authority to make an order requiring changes in the source or sources of water supply. G.S. 1947 Supp., 65-163. Permits for the discharge of sewage from a sewer system are subject to revocation, modification, and change by the State Board of Health upon due notice and after investigation and hearing. G.S.1947 Supp., 65-165. The Board of Health has the duty of making rules and regulations with the approval of the State forestry, fish, and game commission governing the disposal of domestic and industrial sewage wastes for the purpose of preventing stream pollution detrimental to public health or to animal and aquatic life. G.S. 1947 Supp., 65-171d.

Plans and specifications for disposal works for oil-field or gas-field brines and mineralized waters must be submitted to and approved by the State corporation commission and the State Board of Health. The former determines whether the method of disposal will result in loss or waste of gas or petroleum resources, and the Board of Health determines whether the proposed method is a feasible one to protect the water resources of the State from preventable pollution. If the State Board of Health finds upon investigation that the most feasible method is by a disposal well, it so certifies to the commission. Any hearing in such a case is before the commission and the statute provides for judicial review of its order. G.S. 1947 Supp., 55-1003.

The State corporation commission has the duty of making investigations for the purpose of determining whether an abated oil or gas-field is polluting or is likely to pollute any fresh water strata or supply, and it is the commission's duty to plug the well or cause it to be plugged so as to prevent any further pollution or danger of pollution. Sec. 2, ch. 308, Laws of Kansas, 1949.

The State Board has authority to appoint or employ such technical advisers as may be necessary. Gen. St. 1935, 65-171c. The State Board may delegate its duties, in writing, to any of its agencies, sections, or divisions. Sec. 1, ch. 327, Laws of Kansas, 1949.

IV. Exemptions from Operation of Act

When it is the unanimous opinion of the governor, the attorney general, and the secretary of the State Board that the general interests of the public health would be served thereby, the secretary may issue a permit for the discharge of sewage, otherwise prohibited, from a sewer system into the waters of the State under such conditions as may be stipulated in the permit. G.S. 1947 Supp., 65-165.

V. Preservation of Existing Rights and Remedies

Chapter 308, Laws of Kansas, 1949, authorizing the State corporation commission to plug abandoned oil or gas wells which are causing or may cause pollution, contains a provision (Sec. 4) that the act is not to be construed as impairing, affecting, or repealing any existing law, but is merely supplementary thereto.

Unless such construction is inconsistent with the manifest intent of the legislature or repugnant to the context of the statute, the provisions of any statute so far as they are the same as those of any prior statute shall be construed as a continuation of such provisions and not as a new enactment. Gen. St. 1935, 77-201.

VI. Statement of Policy

None

VII. Interstate Agencies

The Kansas State Board of Health participates in the following interstate agencies:

1. The Missouri River Basin Health Council, which includes the States within the area of the Missouri Drainage Basin office. Other participating States are Nebraska, Montana, North Dakota, South Dakota, Wyoming, Minnesota, Colorado, Iowa, and Missouri.

2. The Public Health Service and the health departments of Iowa, Missouri, Kansas, South Dakota, and Nebraska have entered into a written agreement effective as of January 1, 1950, to make a survey of pollution of the Missouri River from Yankton, South Dakota, to the mouth.

3. In addition, the State of Kansas, together with Colorado and Nebraska, have entered into a compact with respect to water's use on the Republican River, which includes provisions for the diversion of water for sanitation purposes.

MISSOURI WATER POLLUTION CONTROL LEGISLATION

I. General Statement

Missouri has no comprehensive water pollution control act. 1/ The duty and responsibility of safeguarding the health of the people is vested in the Division of Health of the Department of Public Health and Welfare. Mo. R.S.A. § 9759.14. The Department of Public Health and Welfare (Division of Health) has been designated by the Surgeon General as the State Water Pollution Control Agency, inasmuch as no other State agency has comprehensive powers.

II. Administrative Organization

The chief administrative officer of the Division of Health is a director appointed by the Governor and must be confirmed by the Senate. The Division Director must be a physician in good standing, a citizen of Missouri, and a graduate of a reputable school of the healing arts, especially trained in sanitary science. Mo. R.S.A. §§ 9759.6 and 9759.16. The Director of the Department of Public Health and Welfare is appointed by the Governor, with Senate confirmation, and appointments of personnel and promulgations of orders and findings made by the Division must be approved by him.

III. Powers and Duties

1. Development of Comprehensive Programs. No statutory authority exists for the development of comprehensive programs.

2. Issuance of Permits and Review of Plans and Specifications. The Missouri statutes contain no specific statutory authority for the issuance of permits or the review of plans and specifications.

3. Enforcement. There is no specific statutory authority for enforcement. Rules and regulations or procedures made by the Division must be followed and obeyed or the person neglecting or refusing to do so shall be guilty of a misdemeanor. Mo. R.S.A. § 9750.

Any person who causes deleterious substances to be placed, run, or drained into any of the waters of Missouri in quantities sufficient to injure, stupefy, or kill fish which may inhabit such waters at or below the point where such substances enter the water shall be deemed guilty of a misdemeanor. This section also provides that it shall not be a violation for any person engaged in industry to cause or permit any waters subject to his control or used in such industry to be so discharged under such precautionary measures as have been specifically approved by the Conservation Commission. Mo. R.S.A. § 8971.19.

1/ During the 1949 session of the Legislature a bill providing for comprehensive water pollution control was passed by the House, but was not acted upon by the Senate.

All rules and regulations authorized and made by the State agency supersede all local ordinances, rules, and regulations, must be observed throughout the State, and are enforced by all local and State health authorities. Mo. R.S.A. § 9748.

It is the duty of the county and city health officers to enforce the rules and regulations of the State Division of Health throughout their respective counties. Section 192.25 of S.B. 1051, approved January 6, 1950.

4. Conduct of Studies, Investigations, and Research. The Division of Health is authorized to make studies of the causes and prevention of diseases. Mo. R.S.A. § 9759.14.

The Director of the Department has the power to make inquiries and investigations. Mo. R.S.A. § 9759.5.

The Director of the Department may establish in his central office a bureau of research and statistics. Mo. R.S.A. § 9759.12. In addition the Division of Health is authorized to maintain such bureaus as may be necessary from time to time. Mo. R.S.A. § 9759.15.

5. Cooperation with Other Public and Private Agencies.

None.

6. Administrative Powers. No specific authority given by statute with respect to water pollution.

Section 192.20 of S.B. 1051, approved January 6, 1950, provides that the approval of new water supplies of new municipalities must necessarily involve consideration of sewage provisions for safety to public health.

The Director of the Department has the power to hold such hearings as may be necessary and has the authority to subpoena witnesses, administer oaths, and provide for the payment and expenses of witnesses. Mo. R.S.A. § 9759.5.

It is the general duty and responsibility of the Division of Health to safeguard the health of the people in the State and all its subdivisions. Mo. R.S.A. § 9759.14.

IV. Exemptions from Operation of Act.

None.

V. Preservation of Existing Rights and Remedies.

None

VI. Statement of Policy.

None.

VII. Interstate Agencies

The Department of Health participates in the following interstate agencies:

1. The Upper Mississippi River Sanitary Board. The other participating States are Minnesota, Wisconsin, Illinois, and Iowa. Among other things the Board has made malaria surveys and sponsored research in the field of sewage treatment.

2. The Missouri River Basin Health Council, which includes the States within the area of the Missouri Drainage Basin office. The other States are Nebraska, Montana, North Dakota, South Dakota, Wyoming, Minnesota, Colorado, Kansas, and Iowa.

3. The Public Health Service and the health departments of Iowa, Missouri, Kansas, South Dakota, and Nebraska have entered into a written agreement effective January 1, 1950, to make a survey of pollution of the Missouri River from Yankton, South Dakota, to the mouth.